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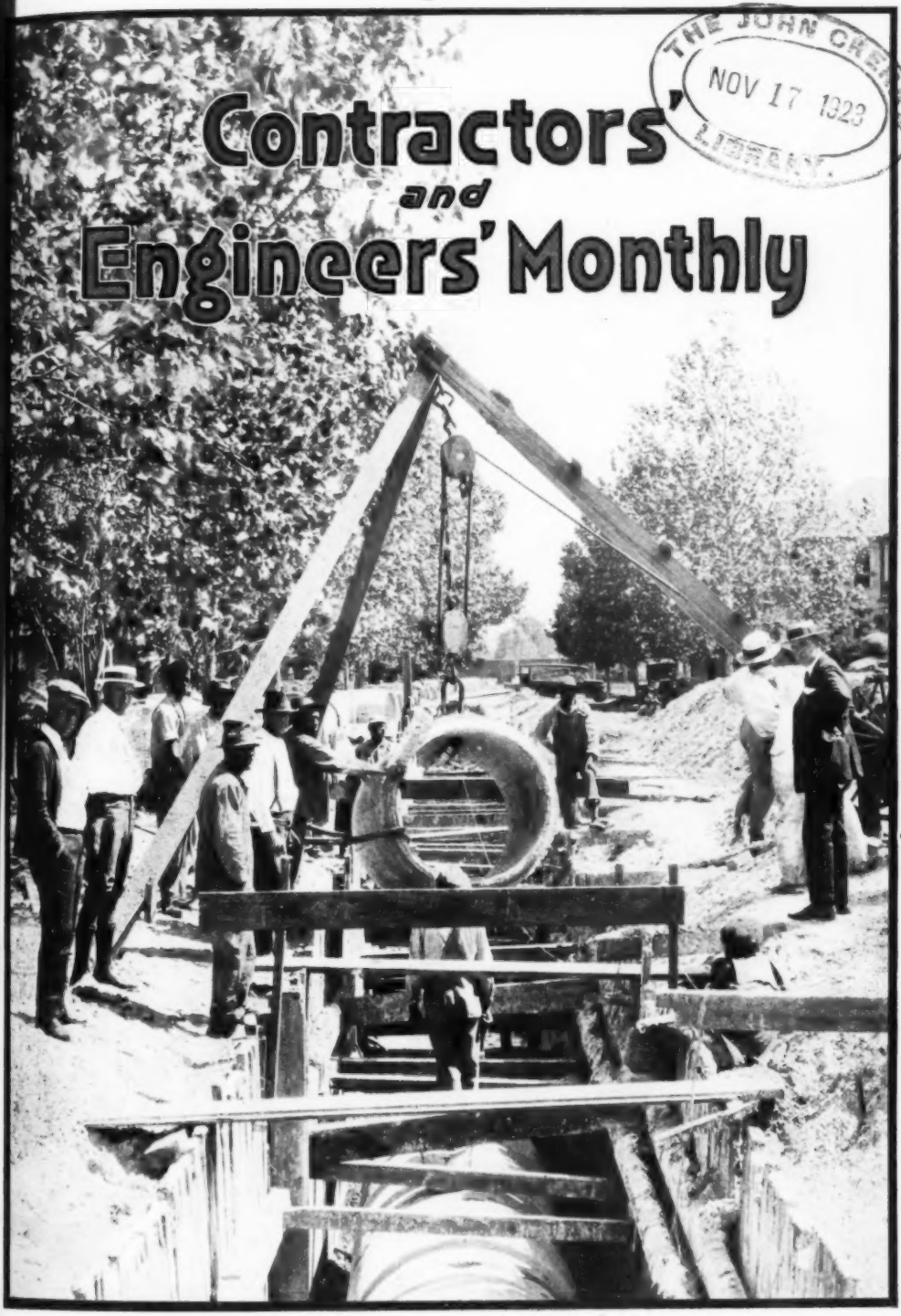
Contractors' and Engineers' Monthly



Laying a 36-Inch Concrete Storm Sewer in Hubbard Street, Jacksonville, Florida

NOVEMBER, 1923 25 Cents $1 a Year

For Better Concrete Roads

Truscon Wire Mesh

Leading highway engineers recognize the value of steel wire mesh in flat sheets for road reinforcement. Truscon Wire Mesh, furnished in widths and areas as desired, comes in flat sheets cut to length. Rigidly connected members keep mesh in perfect form; main members spaced 6 inches and secondary members 12 inches on centers.

Truscon Contraction Joints

Provide a definite plane of weakness in pavement, forming a straight crack for contraction or expansion. The central joint offsets lifting of pavement from subgrade, and serves as a permanent traffic marker. Dowel in plate provides stiffness and interlocking prevents one section rising above the other.

TRUSCON STEEL CO.
Youngstown, Ohio

Warehouses and Offices from Pacific to Atlantic. For addresses see 'phone books of principal cities. Canada: Walkerville, Ont. Export Div.; New York.

TRUSCON
TRUSCON STEEL CO.
WIRE MESH AND CONTRACTION JOINTS

VOL. VII. No. 5 CONTRACTORS' & ENGINEERS' MONTHLY NOVEMBER, 1923
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Price 25 Cents, $1 Yearly

Where to Purchase

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

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Prest-O-Lite Co., Inc., New York.

ACETYLENE APPARATUS
Air Reduction Sales Co., New York.
Oxweld Acetylene Co., Newark, N. J.

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De La Vergne Machine Co., New York.
Domestic Engine & Pump Co., Shippensburg, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
General Electric Co., Schenectady, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York.
Nordberg Mfg. Co., Milwaukee, Wis.
Norwalk Iron Works Co., South Norwalk, Conn.
Schramm, Inc., West Chester, Pa.
Sullivan Mchy. Co., Chicago, Ill.
United Iron Works, Kansas City, Mo.
Westinghouse Trac. Brake Co., Wilmerding, Pa.
Worthington Pump & Mchy. Corp., New York.

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General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

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Am. Well Works, Aurora, Ill.

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Mikesel Bros. Co., Chicago, Ill.
Norristown Mag. & Asb. Co., Norristown, Pa.
Sall Mountain Co., Chicago, Ill.

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*International Motor Co., New York.
*Robins Conv. Belt Co., New York.
Bartlett & Snow Co., C. O., Cleveland O.
Bay City Dredge Wks., Bay City, Mich.
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Byers Mach. Co., Ravenna, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Green Eng. Co., East Chicago, Ind.
Guarantee Constr. Co., New York.
Jeffrey Mfg. Co., Columbus, Ohio.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

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*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Co., New York.
*Warren Bros. Co., Boston, Mass.
Atlantic Refining & Asphalt Corp., Phila., Pa.
Barrett Co., New York.
Gulf Refining Co., Pittsburgh, Pa.
Headley Good Roads Co., Philadelphia, Pa.
Ky. Rock Asphalt Co., Louisville, Ky.
New Orleans Refining Co., New Orleans, La.
Sinclair Ref. Co., Chicago, Ill.
Standard Oil Co. of Calif., San Francisco, Cal.
Standard Oil Co. of La., New Orleans, La.
Standard Oil Co. of N. J., Newark, N. J.
Standard Oil Co. of N. Y., New York.
U. S. Asphalt Refining Co., New York.

ASPHALT BLOCK
Hastings Pavement Co., New York.

ASPHALT CUTTERS
Dayton Pneumatic Tool Co., Dayton, Ohio.
Chicago Pneumatic Tool Co., New York
Ingersoll-Rand Co., New York.

ASPHALT KETTLES. (See Kettles for Asphalt and Tar Heating.)

ASPHALT PLANTS, TOOLS, ETC.
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*Warren Bros. Co., Boston, Mass.
Austin Machinery Corp'n, Toledo, O.
Bacon Co., Edw. R., San Francisco, Cal.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, Ohio.
Hetherington & Berner, Indianapolis, Ind.

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ASPHALT SURFACE HEATERS
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*Equitable Asphalt Maint. Co., Kansas City, Mo.
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*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Koehring Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
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Byers Machine Co., Ravenna, Ohio.
Constr. Mchy. Co., Waterloo, Ia.
Oshkosh Mfg. Co., Oshkosh, Wis.
Parsons Co., Newton, Ia.
Weller Mfg. Co., Chicago, Ill.

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*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Buffalo Forge Co., Buffalo, N. Y.
Concrete Steel Co., New York.
Electric Welding Co., Pittsburgh, Pa.
Hinman & Co., D. A., Sandwich, Ill.
McKenna Co., Cleveland, Ohio.

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*Truscon Steel Co., Youngstown, Ohio.
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Bethlehem Steel Co., Bethlehem, Pa.

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EASY FLOWING CONCRETE

EASY flowing, easy spouting concrete begins with the mixing action. The plasticity that means easy flowing without excess of water depends on the thorough coating of every fragment of stone and grain of sand with cement. Then cement acts as a lubricant — the concrete is plastic, easy flowing, easy to work — a real factor in lower costs.

The Koehring re-mixing actio prevents segregation of aggregate according to size — sends every grain of sand and cement, every fragment of stone through the mixing process for re-mixing. The result is perfect uniformity of concrete from the first to last shovelful of every batch, and a plastic, free flowing concrete that spouts and "works" to great advantage.

This, together with the Koehring *"Heavy Duty"* construction which means long, trouble-free service life, gives the Koehring owner an extra profit margin on every season's work.

Koehring Capacities

Heavy Duty Construction Mixers: 10, 14, 21 and 28 cu. ft. mixed concrete. ***Pavers:*** 7, 10, 14, 21, 32 cu. ft. mixed concrete.

Dandie Light Mixer: 4 and 7 cu. ft. mixed concrete. May be equipped with power skip or low charging platform. Water measuring tank and light duty hoist.

Write for Catalog —

KOEHRING COMPANY

MANUFACTURERS OF CONCRETE MIXERS, CRANES, DRAGLINES, SHOVELS

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Sales offices and service warehouses in all principal cities

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Mexico, F. S. Lapum, Cinco De Mayo 21, Mexico, D. F.

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Gulf States Steel Co., Birmingham, Ala.
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Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Midvale Steel & Ordnance Co., Philadelphia, Pa.
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*Good Roads Mach'y Co., Kennett Square, Pa.
*Ransome Concrete Mach. Co., Dunnellen, N. J.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Fairfield Engineering Co., Lancaster, Ohio.
Green Engineering Co., E. Chicago, Ind.
Link-Belt Co., Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Weller Mfg. Co., Chicago, Ill.

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Chicago Bridge & Iron Works, Chicago, Ill.
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Ingalls Iron Works Co., Birmingham, Ala.
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Louisville Bridge & Iron Co., Louisville, Ky.
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Milwaukee Bridge Co., Milwaukee, Wis.
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Holding Down Your Heavy Haulage Costs

There is no job in contracting and building work that demands greater structural strength and mobile power in a truck than stone hauling. And unless a truck is especially designed for the work, it usually suffers under such severe strains, with resulting delays and losses to the operator.

R. Waddington & Sons, Inc., contractors, of Hoboken, N. J., are veteran specialists in stone hauling. They have learned that even the ordinary good truck cannot stand the "gaff" and earn a profit. That's why they operate a fleet of nine 5-ton Garfords built to handle their job.

The strongly reinforced body of the Garford unit pictured above carries full capacity loads regularly, eliminating replacement and repair expense. This has been a big factor in the extremely low cost ton mile operation which this company reports.

Garford engineers are thoroughly familiar with hauling needs in the building industry. For years these trucking experts have helped contractors solve difficult transportation problems.

Garford publishes a truck operator's magazine—Haul-Age—which will be mailed to you regularly on your request. Write for the latest issue.

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Manufacturers of Motor Trucks 1 to 7½ Tons

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Browning Co., Cleveland, O.
Hayward Co., New York.
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Lakewood Eng. Co., Cleveland, O.
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Owen Bucket Co., Cleveland, Ohio.
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Orton & Steinbrenner Co., Chicago, Ill.
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Lidgerwood Manufacturing Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
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Dalton Adding Mach. Co., Cincinnati, O.
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Easton Car & Constr. Co., New York.
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Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Light Ry. Equipment Co., Philadelphia, Pa.
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United Iron Works, Kansas City, Mo.
Weller Mfg. Co., Chicago, Ill.
Whiting Corp'n, Harvey, Ill.

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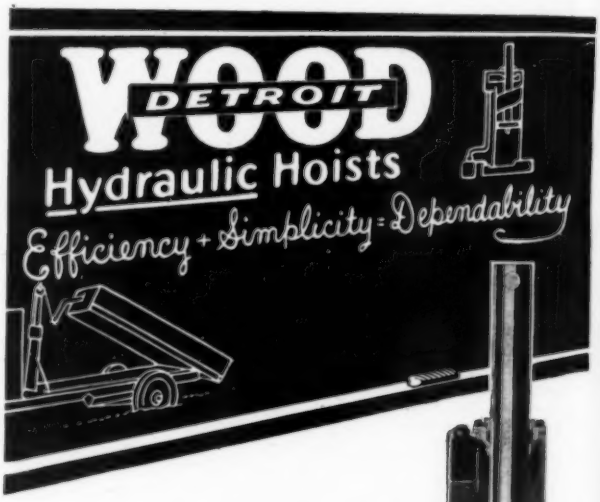
*Ransome Concrete Mchy. Co., Dunellen, N. J.
*Sterling Wheelbarrow Co., Milwaukee, Wis.
Akron Barrow Co., Cleveland, Ohio.
Etnyre & Co., E. D., Oregon, Ill.
Gray Iron Fdry. Co., Reading, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.
Toledo Wheelbarrow Co., Toledo, Ohio.

CAST IRON PIPE (See Pipe, Cast Iron)

Proven by Over a Decade of Use



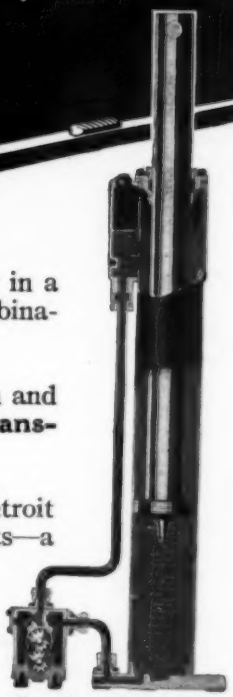
DEPENDABILITY—the most vital quality in a hoist—comes most certainly from a combination of high efficiency and simplicity.

EFFICIENCY is lowered only through friction and there can be **no friction where the power is transmitted by oil.**

SIMPLICITY means few vital parts; Wood-Detroit **Hydraulic** Hoists have but three moving parts—a piston and two steel gears, **all working in oil.**

WOOD-DETROIT Hydraulic Hoist—for over a decade and on over a hundred thousand dump trucks—have proven the dependability that comes from efficiency and simplicity.

That is why Wood-Detroit Hydraulic Hoists are the first choice of more than 90% of the motor truck makers.



Note the simplicity of the hydraulic construction — the absence of bevel gears, chains, sprockets, worm and worm wheels, screw and nuts, thrust bearings, knock-out gearing, and other mechanism liable to friction and breakdown—no moving parts except a piston and two gears *operating in oil.*

WOOD HYDRAULIC HOIST & BODY CO.

World's Largest Makers of Hydraulic Hoists and Dump Wagons

7924 Riopelle Street -:- Detroit, Michigan

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*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
Canton Foundry & Machine Co., Canton, O.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Dee Co., W. E., Chicago, Ill.
Portable Machinery Co., Passaic, N. J.
Foundry Mfg. Co., St. Albans, Vt.
Klauer Mfg. Co., Dubuque, Iowa.
Madison Foundry Co., Cleveland, O.
Pechstein Iron Works, Keokuk, Ia.
Sessions Foundry Co., Bristol, Conn.
South Bend Foundry Co., South Bend, Ind.

CATCH BASINS (See Castings, Street and Sewer)

CATCH BASIN CLEANING APPARATUS

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Elgin Sales Corp., New York.

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Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Mueller Mfg. Co., H., Decatur, Ill.

CEILINGS, METAL

Berger Mfg. Co., Canton, O.
Canton Art Metal Co., Canton, O.
Newport Rolling Mill Co., Newport, Ky.
Klauer Mfg. Co., Dubuque, Iowa.
Mesker & Co., Geo. L., Evansville, Ind.
Milwaukee Corrugating Co., Milwaukee, Wis.
Wheeling Corrugating Co., Wheeling, W. Va.

CEMENT

*Pennsylvania Cement Co., New York
Ætna Portland Cement Co., Detroit, Mich.
Allentown Portland Cement Co., Allentown, Pa.
Alpha Portland Cement Co., Easton, Pa.
Ash Grove Lime and Portland Cement Co., Kansas City, Mo.
Atlas Portland Cement Co., New York.
Bath Portland Cement Co., Philadelphia, Pa.
Beaver Portland Cement Co., Portland, Ore.
Bessemer Limestone and Cement Co., Youngstown, O.
Bonner Portland Cement Co., Kansas City, Mo.
Canada Cement Co., Ltd., Montreal, Canada.
Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.
Castalia Portland Cement Co., Pittsburgh, Pa.
Clinchfield Portland Cement Corp., Kingsport, Tenn.
Colorado Portland Cement Co., Denver, Colo.
Continental Portland Cement Co., St. Louis, Mo.
Coplay Cement Manufacturing Co., Coplay, Pa.
Cowell Portland Cement Co., San Francisco, Cal.
Crescent Portland Cement Co., Wampum, Pa.
Dewey Portland Cement Co., Kansas City, Mo.
Dexter Portland Cement Co., Nazareth, Pa.
Diamond Portland Cement Co., Cleveland, Ohio.
Dixie Portland Cement Co., Chattanooga, Tenn.
Edison Portland Cement Co., New York.
Fredonia Portland Cement Co., Fredonia, Kans.
Giant Portland Cement Co., Philadelphia, Pa.
Gilmore Portland Cement Corp., Gilmore City, Iowa.
Glens Falls Portland Cement Co., Glens Falls, N. Y.
Golden State Portland Cement Co., Los Angeles, Cal.
Gulf States Portland Cement Co., Demopolis, Ala.
Hawkeye Portland Cement Co., Des Moines, Ia.
Helderberg Cement Co., Albany, N. Y.
Hercules Cement Corp., Philadelphia, Pa.
Indiana Portland Cement Co., Indianapolis, Ind.
International Portland Cement Co., Ltd., Spokane, Wash.
Knickerbocker Portland Cement Co., Inc., New York.
Kosmos Portland Cement Co., Louisville, Ky.
Lawrence Portl'd Cement Co., Northampton, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Louisville Cement Co., Louisville, Ky.
Marquette Cement Mfg. Co., Chicago, Ill.
Missouri Portland Cement Co., St. Louis, Mo.
Monarch Cement Co., Humboldt, Kans.
Nazareth Cement Co., Nazareth, Pa.
Newaygo Portland Cement Co., Newaygo, Mich.
Nebraska Cement Co., Denver, Colo.
New Egyptian Portland Cement Co., Fenton, Mich.
New York & New England Cement & Lime Co., New York.
Northwestern States Portland Cement Co., Mason City, Ia.
Ogden Portland Cement Co., Ogden, Utah.
Oklahoma Portland Cement Co., Denver, Colo.
Old Mission Portland Cement Co., San Francisco, Cal.
Olympic Portl'd Cement Co., Ltd., Seattle, Wash.
Oregon Portland Cement Co., Portland, Ore.
Pacific Portland Cement Co., San Francisco, Cal.
Peerless Portland Cement Co., Union City, Mich.
Peninsular Portland Cement Co., Cement City, Mich.
Penn-Allen Cement Co., Allentown, Pa.
Petoskey Portland Cement Co., Petoskey, Mich.
Phœnix Portland Cement Co., Nazareth, Pa.
Portland Cement Co. of Utah, Salt Lake City, Utah.
Pyramid Portland Cement Co., Des Moines, Ia.
Riverside Portl'd Cement Co., Los Angeles, Cal.
San Antonio Portland Cement Co., San Antonio, Tex.
Sandusky Cement Co., Cleveland, Ohio.
Santa Cruz Portland Cement Co., San Francisco, Cal.
Security Cement and Lime Co., Hagerstown, Md.
Signal Mountain Portland Cement Co., Chattanooga, Tenn.
Southern States Portland Cement Co., Rockport, Ga.
Southwest'n Portland Cement Co., El Paso, Tex.
Standard Portland Cement Corp., San Francisco, Calif.
Superior Portland Cement Co., Seattle, Wash.
Texas Portland Cement Co., Dallas, Tex.
Three Forks Portland Cement Co., Denver, Colo.
Tidewater Portland Cement Co., Baltimore, Md.
Trinity Portland Cement Co., Dallas, Tex.
Union Portland Cement Co., Ogden, Utah.
United States Potash Co., Los Angeles, Cal.
U. S. Portland Cement Co., Denver, Colo.
Universal Portland Cement Co., Chicago, Ill.
Vulcanite Portland Cement Co., Philadelphia, Pa.
Wabash Portland Cement Co., Detroit, Mich.
Wellston Iron Furnace Co., Jackson, Ohio.
Western States Portland Cement Co., Independence, Kans.
Whitehall Cement Mfg. Co., Philadelphia, Pa.
Wolverine Portl'd Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Detroit, Mich.

CEMENT GUNS

Cement Gun Co., Allentown, Pa.

CEMENT INSPECTION (See Inspecting Laboratories)

CHAINS

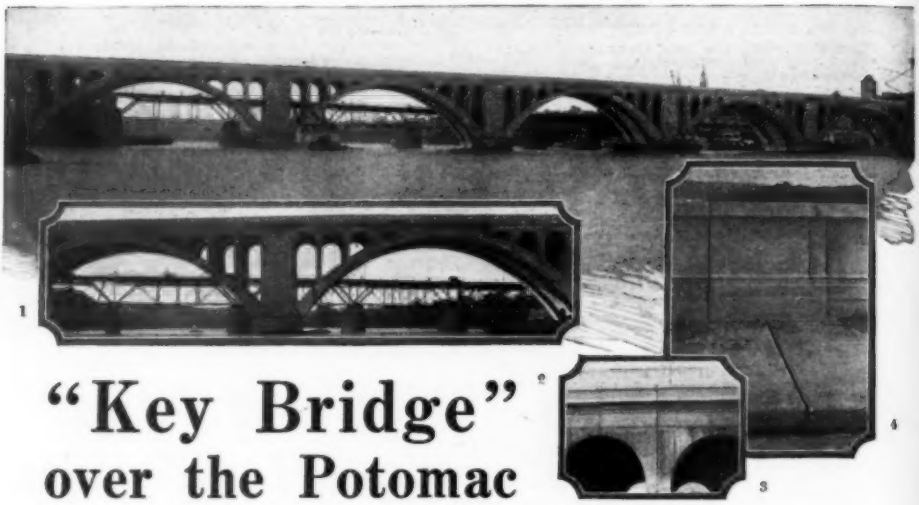
American Chain Co., Inc., Bridgeport, Conn.
Chain Belt Co., Milwaukee, Wis.
Columbus McKinnon Chain Co., Columbus, O.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Niagara Metal Stamp Corp., Niagara Falls, N. Y.
U. S. Chain & Forge Co., Pittsburgh, Pa.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CHEMICALS FOR WATER PURIFICATION

Du Pont de Nemours & Co., E. I., Wilmington, Del.
Electro Bleaching Gas Co., New York.
General Chemical Co., New York.
Mathieson Alkali Works, Inc., New York.
Penna. Salt Mfg. Co., Philadelphia, Pa.

CHIMNEYS, CONCRETE

Heine Chimney Co., Chicago, Ill.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.



"Key Bridge" over the Potomac

"KEY BRIDGE," named after Francis Scott Key, composer of the "Star Spangled Banner," has been recently completed by the U. S. Army Engineer Corps.

The length of this splendid concrete bridge is 2700 feet. It is 70 feet wide and 85 feet above mean low water. It accommodates two 16-foot roadways, two 8-foot sidewalks and a double-track electric railway.

Elastite Expansion Joint is used in the spandrel piers and walls, hand-rails, and sidewalks, being particularly desirable in this type of construction because of its easy handling and installation.

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1 — View of "Key Bridge," Washington, D. C.

2 — Close-up of center arches.

3 — Elastite Expansion Joint in spandrel pier.

4 — Elastite Expansion Joint in sidewalk and hand-rail.

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Carey Elastite Expansion Joint is an asphaltic body, formed of a high-grade asphaltic compound carefully refined and tempered, sandwiched between two walls of asphalt-saturated felt forming an elastic, compressible joint. It is made in lengths, widths and thicknesses as required, can be cut to crown or to any special shape and comes to the job ready to use.

11-23

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American Chimney Corp., New York
Custodis Chimney Const. Co., Alphons, New York
Heine Chimney Co., Chicago, Ill.
Heinicke, Inc., H. R., Indianapolis, Ind.
Kellogg & Co., M. W., New York.
Rust Engineering Co., Pittsburgh, Pa.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS
*Wallace & Tiernan Co., Inc., Newark, N. J.

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Akron Barrow Co., Cleveland, Ohio
Insley Mfg. Co. Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

CLIPS, WIRE ROPE
American Hoist & Derrick Co., St. Paul, Minn.
Marion Malleable Iron Works, Marion, Ind.
Mockbee & Co., C. M., Cincinnati, O.
Roebling Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.

COAL AND ORE CONVEYING MACHINERY
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Robins Conv. Belt Co., New York.
Barber-Greene Co., Aurora, Ill.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Brown Hoisting Mchy. Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kon-Wald Co., Buffalo, N. Y.
Lidgerwood Mfg. Co., New York.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

COCKS, CURB AND CORPORATION
*Union Water Meter Co., Worcester, Mass.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.
Mueller Mfg. Co., H., Decatur, Ill.

COLUMN CLAMPS
*Sterling Wheelbarrow Co., Milwaukee, Wis.
Hydraulic Steelcraft Co., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
Universal Form Clamp Co., Chicago, Ill.

COMPRESSORS, AIR (See Air Compressors)

CONCRETE FLOOR HARDENER
*Truscon Laboratories, Detroit, Mich.
Anti-Hydro Waterproofing Co., Newark, N. J.
General Chemical Co., New York.
General Fireproofing Co., Youngstown, Ohio.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders Co., Cleveland, O.
Sonneborn Sons, Inc., L., N. Y. "Lapidolith"

CONCRETE MIXERS
*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Jaeger Machine Co., Columbus, O.
*Atlas Eng. Co., Milwaukee, Wis.
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellan, N. J.
Austin Machinery Corp'n, Toledo, O.
Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Iowa.
Contractors' Equipment Co., Keokuk, Ia.
Foote Concrete Mchy. Co., Chicago, Ill.
Gray Iron Fdry Co., Reading, Pa.
Judy Mfg. Co., Centerville, Ia.
Knickerbocker Co., Jackson, Mich.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Marsh-Capron Co., Chicago, Ill.
Milwaukee Concrete Mixer Co., Milwaukee, Wis.
Oshkosh Mfg. Co., Oshkosh, Wis.
Republic Iron Works, Tecumseh, Mich.
Schramm, Inc., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
Standard Scale & Supply Co., Pittsburgh, Pa.
Truckmixer Co., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

CONCRETE PILING. (See Piling, Concrete)

CONCRETE REINFORCEMENT
*Truscon Steel Co., Youngstown, O.
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Concrete Steel Co., New York.
Consolidated Expanded Metal Co., Braddock, Pa
Corrugated Bar Co., Inc., Buffalo, N. Y.
Electric Welding Co., Pittsburgh, Pa.
General Fireproofing Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
National Steel Fabric Co., Pittsburgh, Pa.
Ryerson & Son., J. T., Chicago, Ill.
Wickwire Spencer Steel Corp., New York.
Youngstown Pressed Steel Co., Warren, O.
Youngstown Sheet & Tube Co., Youngstown, O.

CONCRETE ROAD FINISHERS
*Dunn Road Mach. Co., Conneaut, Ohio.
Heltzel Steel Form & Iron Co., Warren, O.
Lakewood Eng. Co., Cleveland, Ohio

CONCRETE TOOLS
*Dallett Co., Thos. H., Philadelphia, Pa.

CONDENSERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mach'y Corp., New York.

CONDUIT RODS
Bissell Co., F., Toledo, Ohio.
Turbine Sewer Machine Co., Milwaukee, Wis.
Waldo Bros. & Bond Co., Boston, Mass.

CONDUITS, INTERIOR
American Circular Loom Co., New York.
Central Tube Co., Pittsburgh, Pa.
Clifton Mfg. Co., Boston, Mass.
Garland Mfg. Co., W. Pittsburgh, Pa.
National Enam. & Mfg. Co., Pittsburgh, Pa.
National Metal Molding Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Beaver, Pa.
Sprague Electric Wks., New York
Steelduct Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

CONDUITS, UNDERGROUND
American Vitrified Products Co., Akron, Ohio
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Fibre Conduit Co., Orangeburg, N. Y.
Johns-Manville, Inc., New York.
National Fireproofing Co., New York.

CONTRACTORS' SUPPLY DEALERS
(See pages 83-98)

CONTRACTORS' USED EQUIPMENT
*Haetten Co., J. E., New York.
*Kleinhans Co., H., Pittsburgh, Pa.

CONVEYORS, BELT
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Robins Conv. Belt Co., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Barber-Greene Co., Aurora, Ill.
Chain Belt Co., Milwaukee, Wis.

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*Russell Grader Mfg. Co., Minneapolis, Minn.
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Bartlett & Snow Co., C. O., Cleveland, O.
Caldwell & Son, H. W., Chicago, Ill.
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Fairfield Engineering Co., Lancaster, Ohio.
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Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constn. Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
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Republic Rubber Co., Youngstown, O.
Stephens Adamson Mfg. Co., Aurora, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CONVEYORS, GRAVITY

Alvey-Ferguson Co., Cincinnati, O.
Dow Co., Louisville, Ky.
Lamson Co., Syracuse, N. Y.
Mathews Gravity Carrier Co., Elwood City, Pa.
Standard Conveyor Co., No. St. Paul, Minn.

CRANES, LOCOMOTIVE

*Koehring Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravena, O.
Davenport Locomotive Works, Davenport, Ia.
Erie Steam Shovel Co., Erie, Pa.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Overland Crane Co., Hammond, Ind.
Thew Shovel Co., Lorain, O.
U. S. Crane Co., Chicago, Ill.

CRANES, OVERHEAD TRAVELING

*Pawling & Harnischfeger Co., Milwaukee, Wis.
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Chesapeake Iron Wks., Baltimore, Md.
Champion Engineering Co., Kenton, O.
Milwaukee Electric Crane Co., Milwaukee, Wis.
Morgan Engineering Co., Alliance, O.
Northern Eng. Works, Detroit, Mich.
Shaw Crane Works, Muskegon, Mich.
Shepard Elec. Cr. & Hst. Co., Montour Falls, N.Y.
Toledo Crane Co., Bucyrus, O.
Whiting Fdry. & Equip. Co., Harvey, Ill.

CRANES, WRECKING

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Industrial Works, Bay City, Mich.

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American Creosote Works, Inc., N. Orleans, La.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Colonial Creosoting Co., Inc., Bogalusa, La.
Creosoted Materials Co., New Orleans, La.
Georgia Creosoting Co., Brunswick, Ga.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Granite City, Ill.
Republic Creosoting Co., Indianapolis, Ind.
Southern Paving Constr. Co., Chattanooga, Tenn.
Southern Wood Pres. Co., Atlanta, Ga.
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Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Slidell, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buchanan Co., C. G., New York.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Worthington Pump & Machy. Corp., New York.

CRUSHERS, ROCK

*Austin-Western Road Mach. Co., Chicago, Ill.
*Galion Iron Wks. & Mfg. Co., Galion, Ill.
*Good Roads Machinery Co., Kennett Square, Pa.
*Universal Road Machinery Co., Kingston, N. Y.
Acme Road Machy. Co., Frankfort, N. Y.
Case Threshing Mach. Co., J. I., Racine, Wis.
Chalmers & Williams, Chicago Hts., Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York.
Lewistown Fdry. & Mach. Co., Lewistown, Pa.
McLanahan Stone Mach. Co., Hollidaysburg, Pa.
Morgan Engineering Co., Alliance, O.
New Holland Mach. Co., New Holland, Pa.
Smith Eng. Wks., Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Universal Crusher Co., Cedar Rapids, Ia.

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*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Galion Iron Works & Mfg. Co., Galion, Ohio.
*Good Roads Machinery Co., Kennett Square, Pa.
*Newport Culvert Co., Newport, Ky.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmington, Ala.
Canton Culvert & Silo Co., Canton, O.
Concrete Form Co., Inc., Syracuse, N. Y.
Dee Co., W. E., Chicago, Ill.
Dominion Metal Products Corp., Roanoke, Va.
Florida Metal Products Co., Jacksonville, Fla.
Hardesty Mfg. Co., The R., Denver, Colo.
Klauer Mfg. Co., Dubuque, Ia.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Madison Foundry Co., Cleveland, O.
Southern Metal Culvert Co., Salisbury, N. C.
Wheeling Corrugating Co., Wheeling, W. Va.
Wood & Co., R. D., Philadelphia, Pa.

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*Clark Co., H. W., Mattoon, Ill.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Foundry Mfg. Co., St. Albans, Vt.
Madison Foundry Co., Cleveland, O.
Mueller Mfg. Co., Decatur, Ill.
Thompson-Fleming Co., Inc., Buffalo, N. Y.

CURB GUARDS, STEEL

*Godwin Co., W. S., Baltimore, Md.

CURB, STEEL PROTECTED

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Concrete Steel Co., New York.
National Steel Fabric Co., Pittsburgh, Pa.
Steel Protected Concrete Co., Philadelphia, Pa.

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Road Contractors Use

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Extra heavy construction makes them exceptionally durable and able to withstand hard usage. Proper design gives them the greatest operating efficiency and the compact arrangement makes them easy to handle and move about.

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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
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Sasgen Derrick Co., Chicago, Ill.
Smith, Whitcomb & Cook Co., Barre, Vt.
Superior Iron Works, Superior, Wis.

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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Mueller Mfg. Co., H., Decatur, Ill.

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Hayward Co., New York.
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Lidgerwood Manufacturing Co., New York.
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Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill

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Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Nat'l Hoisting Engine Co., Harrison, N. J.
Orton & Steinbrenner Co., Chicago, Ill.

DIESEL ENGINES. (See Engines, Oil)

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*Kinney Mfg. Co., Boston, Mass.

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*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Archer Iron Works, Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

DITCHING MACHINES (See Excavators, Ditch and Trench)

DIVIDING PLATES (ROAD)
*Godwin Co., W. S., Baltimore, Md.

DOORS, METAL
Central Metal Products Corp., Canton, Ohio.
Dahlstrom Metallic Door Corp., Jamestown, N. Y.
Friedrich Co., E. H., Holyoke, Mass.
Lawton-Stephens Co., Brooklyn, N. Y.
McFarland Co., J. C., La Porte, Ind.
Penn Metal Co., Boston, Mass.
Riester & Thesmacher Co., Cleveland, Ohio.
Sykes Co., Chicago, Ill.
Thorp Fireproof Door Co., Minneapolis, Minn.

DOORS AND SHUTTERS, STEEL ROLLING
Cornell Iron Works, New York.
Kinnear Mfg. Co., Columbus, O.
Variety Mfg. Co., Chicago, Ill.
Wilson Corp., J. G., New York.

DRAFTING MACHINES
Universal Drafting Machine Co., Cleveland, O.

DREDGES
American Steel Dredge Co., Fort Wayne, Ind.
Bay City Dredge Works, Bay City, Mich.
Bucyrus Co., South Milwaukee, Wis.
Ellicott Machine Corp'n., Baltimore, Md.
Erie Steam Shovel Co., Erie, Pa.
Hayward Co., New York.
Lidgerwood Mfg. Co., New York.
Marion Steam Shovel Co., Marion, O.
Osgood Co., The, Marion, O.
Stockton Iron Works, Stockton, Cal.
Street Bros. Mach. Wks., Chattanooga, Tenn.
Superior Iron Works, Superior, Wis.
Vulcan Iron Works, Jersey City, N. J.

DREDGES, DIPPER
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Bucyrus Co., South Milwaukee, Wis.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

DREDGES, HYDRAULIC
Bucyrus Co., South Milwaukee, Wis.
Ellicott Mach. Corp., Baltimore, Md.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

DREDGING PUMPS AND ACCESSORIES
Erie Pump & Engine Wks., Medina, N. Y.

DRILLS, AIR
*Dallett Co., Thos. H., Philadelphia, Pa.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, CORE
*McKiernan-Terry Drill Co., New York.
Dobbins Core Drill Co., Inc., New York.
Ingersoll-Rand Co., New York.
Standard Diamond Drill Co., Chicago, Ill.
Sullivan Mach'y Co., Chicago, Ill.

DRILLS, HAMMERS (PNEUMATIC)
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, O.
Ingersoll-Rand Co., New York.
Natl. Elec. Mfg. Co., Pittsburgh, Pa.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, ROCK
*Dallett Co., Thos. H., Philadelphia, Pa.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
*Wood Drill Works, Paterson, N. J.
Chicago Pneumatic Tool Co., New York.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Natl. Elec. Mfg. Co., Pittsburgh, Pa.
Sullivan Machinery Co., Chicago, Ill.

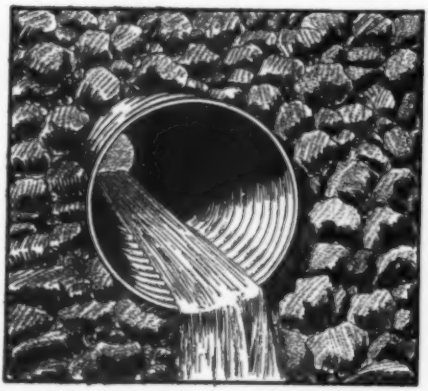
DRILLS FOR WELLS AND BLAST HOLES (See Well Drilling Machinery)

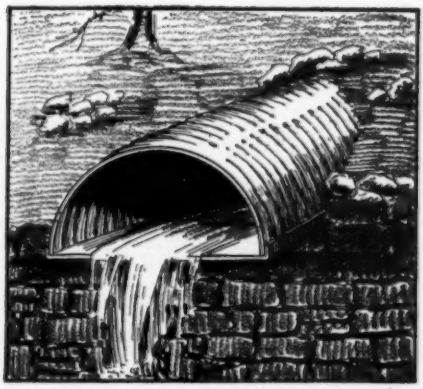
GENUINE OPEN-HEARTH IRON

RUST-RESISTING

CULVERTS

The high quality of the material used and the adaptability of Newport round and half-round types of corrugated culvert pipe, to the needs of the road builders, make NEWPORT GENUINE OPEN-HEARTH IRON corrugated metal culverts the standard for road work everywhere. The iron has had the impurities eliminated to an extent not usually reached in any other grade of pure iron. This makes the culverts rust-resisting and the corrugations give them strength, thus assuring the road master or engineer that he is buying a high-grade culvert.





Newport culvert pipes of round, riveted, full-circle construction, are the strongest corrugated metal culverts manufactured. They are easily installed and last a lifetime. The half-round flat-bottom culvert pipe is particularly adapted to city use. It is made in 2-foot lengths so that whenever a pipe becomes clogged it is easy to dig down and lift the section immediately above where the clogged condition exists, clean out and replace it with no necessity of interfering with traffic or the expense of digging up the whole pipe.

NEWPORT CULVERT CO.

542 West Tenth St., Newport, Kentucky

DRUMS, HOLDING

Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Monighan Machine Co., Chicago, Ill.

DRYERS, ASPHALT AND CEMENT

Allis-Chalmers Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
American Process Co., New York.
Atlas Dryer Co., Cleveland, O.
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Ruggles-Coles Eng. Co., New York.
Variety Iron & Steel Works, Cleveland, O.

DRYERS, SAND AND GRAVEL

*Littleford Bros., Cincinnati, Ohio.

DUMP BODIES FOR MOTOR TRUCKS

*Hall Company, Milwaukee, Wis.
*International Motor Co., New York.
*Littleford Bros., Cincinnati, O.
*Wood Hydr. Hoist & Body Co., Detroit, Mich.
(Horizontal Hydraulic Hoist Co., Detroit, Mich.)
Archer Iron Works, Chicago, Ill.
Auto Truck Steel Body Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Columbia Wagon & Body Co., Columbia, Pa.
Jennings Automatic Dump Body, Roanoke, Va.
Lee Trailer & Body Co., Chicago, Ill
Pechstein Iron Works, Keokuk, Iowa.
Simplex Mfg. Co., Connellsville, Pa.
Van Dorn Iron Wks., Cleveland, Ohio.

DUMP CARTS AND WAGONS, HORSE DRAWN

*Austin Western Road Mchy. Co., Chicago, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Acme Road Machinery Co., Frankfort, N. Y.
Acme Wagon Co., Emigsville, Pa.
Austin Mfg. Co., Chicago, Ill.
Columbia Wagon & Body Co., Columbia, Pa.
Eagle Wagon Works, Auburn, N. Y.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Stroud & Co., Omaha, Nebr.
Tiffin Wagon Co., Tiffin, Ohio.
Watson Products Corp., Canastota, N. Y.
Western Wheeled Scraper Co., Aurora, Ill.

DUST LAYING (CALCIUM CHLORIDE)

*Dow Chemical Co., Midland, Mich.
*Solvay Process Co., Solvay, N. Y.
Carbondale Calcium Co., Carbondale, Pa.

DYNAMITE (See Explosives)

EJECTORS, SEWAGE

Pacific Flush Tank Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC GENERATORS AND MOTORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Ideal Elec. & Mfg. Co., Mansfield, O.
Lincoln Electric Co., Cleveland, O.
Robbins & Myers Co., Springfield, O.
Triumph Electric Co., Cincinnati, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Western Electric Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC LAMPS

General Electric Co., Schenectady, N. Y.
Westinghouse Lamp Co., New York.

ELECTRIC LIGHTING PLANTS

*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Western Electric Co., New York.

ELECTRIC SUPPLIES, METERS, ETC.

Bissell Co., F., Toledo, Ohio.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC TRANSFORMERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC WIRES AND CABLES. (See "Wire and Cable")

ELEVATORS, BUCKET

*Atlas Eng. Co., Milwaukee, Wis.
*Austin Western Road Machy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Littleford Bros., Cincinnati, Ohio.
*Robins Conv. Belt Co., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

ELEVATORS, PASSENGER, FREIGHT, ETC.

Albro-Clem Elevator Co., Philadelphia, Pa.
Amer. Elevator & Mach. Co., Louisville, Ky.
Bay State Elevator Co., Springfield, Mass.
Haughton Elev. & Mach. Co., Toledo, Ohio.
Kaestner & Hecht Co., Chicago, Ill.
Llewellyn Iron Works, Los Angeles, Cal.
Montgomery Elevator Co., Moline, Ill.
Otis Elevator Co., New York.
Ridgeway & Son Co., C., Coatesville, Pa.
See Elec. Elevator Co., A. B., New York.
Speidel, J. G., Reading, Pa.
Warner Elevator Mfg. Co., Cincinnati, O.
Warsaw Elevator Co., Warsaw, N. Y.

ENGINES, GAS AND GASOLINE

*Climax Engineering Co., Clinton, Ia.
*Hercules Corpn., Evansville, Ind.
*Holt Mfg. Co., Peoria, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buda Co., Harvey, Ill.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
Domestic Engine & Pump Co., Shippensburg, Pa.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, Ohio.
Fuller & Johnson Mfg. Co., Madison, Wis.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
Nelson Bros. Co., Saginaw, Mich.
"New-Way" Motor Co., Lansing, Mich.
Novo Engine Co., Lansing, Mich.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Wellman-Seaver-Morgan Co., Cleveland, O.
Worthington Pump & Mchy. Corp., New York

ENGINES, OIL

DIESEL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Busch-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
Dodge Sales & Eng. Co., Mishawaka, Ind.
Fulton Iron Works Co., St. Louis, Mo.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
McIntosh & Seymour Corp., Auburn, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.
Western Machy. Co., Los Angeles, Cal.

SEMI-DIESEL

Anderson Fdry. & Mach. Co., Anderson, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
Buckeye Machinery Co., Lima, O.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York
De La Vergne Machine Co., New York
Evinrude Motor Co., Milwaukee, Wis.

For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

Auto Heater and Distributor PATENT COMBINATION

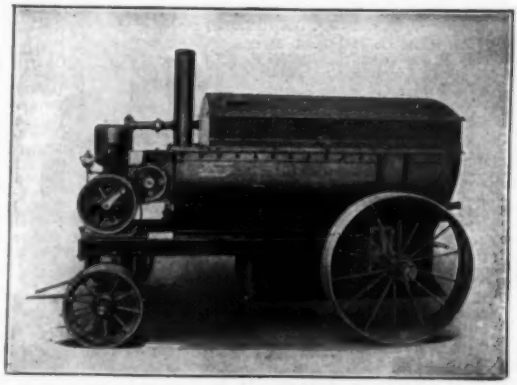
QUALITY Kinney EFFICIENCY

HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of materials, Pump, Piping, Hose, Nozzles, AutomaticallyHeated.

No Steam Required.



Kinney Manufacturing Company

3529 Washington Street

BOSTON, MASSACHUSETTS

BRANCHES:

NEW YORK PHILADELPHIA CHICAGO SAN FRANCISCO HOUSTON KANSAS CITY

Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, O.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.
Muncie Oil Eng. Co., Muncie, Ind.
Nordberg Mfg. Co., Milwaukee, Wis.
St. Mary's Oil Eng. Co., St. Charles, Mo.
Stover Mfg. & Engine Co., Freeport, Ill.
Taylor Machine Co., Cleveland, O.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, PUMPING

*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hooven, Owen, Rentschler Co., Hamilton, O.
Murray Iron Wks., Burlington, Ia.
Nordberg Mfg. Co., Milwaukee, Wis.
Worthington Pump & Mchy. Corp., New York.

ENGINES, STEAM

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dake Engine Co., Grand Haven, Mich.
Erie-Ball Engine Co., Pittsburgh, Pa.
Erie Pump & Engine Co., Medina, N. Y.
Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Leffel Co., J., Springfield, O.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Nordberg Mfg. Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY

Bucyrus Co., South Milwaukee, Wis.
Lidgerwood Mfg. Co., New York.

EXCAVATORS, DITCH AND TRENCH

*Keystone Driller Co., Beaver Falls, Pa.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Byers Machine Co., Ravenna, Ohio.
Ball Engine Co., Erie, Pa.
Buckeye Traction Ditcher Co., Findlay, Ohio.
Bucyrus Co., South Milwaukee, Wis.
Clyde Iron Works Sales Co., Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Fairbanks Steam Shovel Co., Marion, O.
Hayward Co., The, New York City.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

EXCAVATORS, DRAG-LINE

*Bay City Dredge Works, Bay City, Mich.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Sauerman Bros., Chicago, Ill.
Austin Machinery Corp'n, Toledo, O.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Gade Excavator Works, C. L., Iowa Falls, Iowa
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.
Smith Co., T. L., Milwaukee, Wis.

EXPANDED METAL

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Northwestern Expanded Metal Co., Chicago, Ill.
Youngstown Pressed Steel Co., Warren, O.

EXPANSION JOINT MATERIAL

*Barber Asphalt Co., Philadelphia, Pa.
*Carey Co., Philip, Cincinnati, Ohio.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Texas Company, New York.
*Truscon Steel Co., Youngstown, O.
*Waring-Underwood Co., Philadelphia, Pa.
Barrett Co., New York.
Servicised Products Co., Chicago, Ill.

EXPLOSIVES

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., E.I., Wilmington, Del.
Giant Powder Co., Cons., San Francisco, Cal.
Hercules Powder Co., Wilmington, Del.

FENCING

Adrian Wire Fence Co., Adrian, Mich.
American Steel & Wire Co., Chicago, Ill.
Anchor Post Iron Works, New York.
Cyclone Fence Co., Waukegan, Ill.
Frost-Superior Fence Co., Cleveland, O.
Indiana Steel & Wire Co., Muncie, Ind.
Nitselman Bros., Muncie, Ind.
Michigan Wire Fence Co., Adrian, Mich.
Page Steel & Wire Co., Bridgeport, Conn.
Pittsburgh Steel Co., Pittsburgh, Pa.
Stewart Iron Works Co., Cincinnati, Ohio.
Texas Cyclone Fence Co., Fort Worth, Tex.
Wickwire Spencer Steel Corp., New York.
Youngstown Sheet & Tube Co., Youngstown, O.

FILING EQUIPMENT, STEEL

Art Metal Constr. Co., Jamestown, N. Y.
Berger Mfg. Co., Canton, O.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works, Cleveland, O.

FILTERS, OIL

Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

FILTERS, WATER

American Water Softener Co., Philadelphia, Pa.
Graver Corporation, E. Chicago, Ind.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewel Filtr. Co., Nutley, N. J.
Norwood Engineering Co., Florence, Mass.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.

FIRE ALARM SYSTEMS

Gamewell Fire Alarm Tel. Co., Newton Upper Falls, Mass.

FIRE ALARM SIRENS

Erick Elec. Siren Co., St. Paul, Minn.
Federal Sign System, Chicago, Ill.
Hendrie & Bolthoff Mfg. & Sup. Co., Denver, Col.
Interstate Machine Prod. Co., Rochester, N. Y.
Sireno Co., Stapleton, N. Y.
Union Water Meter Co., Worcester, Mass.

FIRE APPARATUS, MOTOR

*International Motor Co., New York.
Ahrens-Fox Fire Engine Co., Cincinnati, O.
American-La France Fire Eng. Co., Elmira, N. Y.
Brockway Motor Fire App. Co., Cortlandt, N. Y.
Northern Fire Apparatus Co., Minneapolis, Minn.
Foamite-Childs Corp., Utica, N. Y.
Firach & Sons Co., Peter, Kenosha, Wis.
Prospect Mfg. Co., Prospect, O.
Seagrave Co., Columbus, O.
Stutz Fire Engine Co., Indianapolis, Ind.
Waterous Fire Engine Co., St. Paul, Minn.

FIRE EXTINGUISHERS, CHEMICAL

American-La France Fire Eng. Co., Elmira, N. Y.
Cross Mfg. Co., C. J., Inc., New York.
Foamite-Childs Co., Utica N. Y.
Pyrene Mfg. Co., Newark, N. J.

FIRE HOSE. (See Hose, Fire)

FIREPROOF BUILDING MATERIAL

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Delaware Clay Products Co., Pittsburgh, Pa.
Detroit Steel Prod. Co., Detroit, Mich.
General Fireproofing Co., Youngstown, O.

Why this New Jersey Contractor Swung Back to the Jaeger

HIS first concrete mixer was a Jaeger. It made money for him—but he took its excellent qualities for granted. Then along came a salesman and induced him to buy a drum type mixer—but he couldn't afford to run it. This is what he told the Jaeger distributor: "This mixer (not a Jaeger) is just as good as the day we bought it. We haven't had a bit of trouble with it. It cost us $800 but we will sell it for $400. We want a Jaeger."

He sold the mixer and bought a Jaeger 4L—because—**"the other mixer took 8 men to do the work that a Jaeger would do with 5 men."** He proved that he could save many dollars every day by using the Jaeger!

A Better Mixer in Many Ways

The Jaeger has an enviable reputation for speed and labor-saving. It loads quickly, mixes fast and discharges the batch almost instantly **because it Tilts and Pours.** Records prove you can average a Mix-a-Minute.

The Jaeger is light yet strong—and it is extremely simple. It is a real engineering achievement. Its many superior features are fully explained in the new Jaeger catalog. Write for it to-day.

THE JAEGER MACHINE CO.

701 Dublin Ave. Columbus, Ohio

It is infringement to make, use or sell a patented invention without authority under the patent. Our patents have been sustained by the United States Courts in six different instances. Purchasers of our Mixers are protected.

Keasbey & Mattison Co., Ambler, Pa.
Kinnear Mfg. Co., Columbus, O.
National Fireproofing Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.
Youngstown Pressed Steel, Co., Warren, O.

FIRST AID EQUIPMENT
American-La France Fire Eng. Co., Elmira, N. Y.

FLEXIBLE JOINTS
*Central Foundry Co., New York.
*U. S. C. I. Pipe & Fdry Co., Burlington, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
United Lead Company, New York.

FLOORING, COMPOSITION
*Barber Asphalt Co., Philadelphia, Pa.
Am. Mason Safety Tread Co., Lowell, Mass.
Barrett Co., New York.
Johns-Manville Co., H. W., New York.
Marine Decking & Supply Co., Phila., Pa.
Muller, Franklyn R., & Co., Waukegan, Ill.

FLOORS, WOOD BLOCK
Barrett Co., New York.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Servicised Products Co., Chicago, Ill.
Sou. Wood Preserving Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

FLUSH TANKS
Pacific Flush Tank Co., Chicago, Ill.

FLUSHERS, STREET. (See Street Flushers and Sprinklers.)

FORGES
Buffalo Forge Co., Buffalo, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.

FORM CLAMPS
Insley Mfg. Co., Indianapolis, Ind.
Marion Malleable Iron Works, Marion, Ind.
Universal Form Clamp Co., Chicago, Ill.

FORMS, CONCRETE
*Connery & Co., Philadelphia, Pa.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Concrete Form Co., Inc., Syracuse, N. Y.
Hetzel Steel Form & Iron Co., The, Warren, O.
Lakewood Eng. Co., Cleveland, Ohio.
Metal Forms Corp., Milwaukee, Wis.

FOUNTAINS, DRINKING
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, Jas. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Mott Iron Wks., J. L., New York.
Murdock Mfg. & Supply Co., Cincinnati, Ohio.
Pure San. Dr. Ftn. Co., Haydenville, Mass.
Randle-Spence Mfg. Co., Milwaukee, Wis.
Stewart Iron Works Co., Cincinnati, O.
Taylor Co., Halsey W., Warren, O.
Twentieth Century Brass Wks., Belleville, Ill.

FURNITURE AND FILES, STEEL
Art Metal Constn. Co., Jamestown, N. Y.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works Co., Cleveland, O.

GARBAGE CANS. (See Cans)

GARBAGE DISPOSAL
Balmer Corp., New York.
Bartlett, C. O. & Snow Co., Cleveland, O.
Decarie Incinerator Co., Minneapolis, Minn.
Jones & Very, New York
Morse-Boulger Destructor Co., New York.
Nye Odorless Crematory Co., Macon, Ga.

GARBAGE TRUCKS AND WAGONS
*Austin Western Road Mchy. Co., Chicago, Ill.
*Heil Co., Milwaukee, Wis.
*International Motor Co., New York.
Autocar Co., Ardmore, Pa.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Lee Trailer & Body Co., Chicago, Ill.
Service Motor Truck Co., Wabash, Ind.
Tiffin Wagon Co., Tiffin, O.
Watson Products Corp., Canastota, N. Y.
White Co., Cleveland, O.

GAS ENGINES. (See Engines, Gas and Gasoline.)

GAS METERS. (See Meters, Gas)

GAS PRODUCERS
Camden Iron Works, Camden, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

GASOLINE STORAGE TANKS
*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Bigga Boiler Works, Akron, Ohio.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Byers Machine Co., Ravenna, Ohio.
Chicago Bridge & Iron Works, Chicago, Ill.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Kansas City, Mo.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

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Chapman Valve Mfg. Co., Indian Orchard, Mass
Coffin Valve Co., Boston, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y.
Hardesty Mfg. Co., R., Denver, Col.

GAUGES, RECORDING, PRESSURE, STEAM
Ashcroft Mfg. Co., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Crosby Steam Gauge & Valve Co., Boston, Mass
Marsh & Co., Jas. P., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
U. S. Gauge Co., New York

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Lunkenheimer Co., Cincinnati, O.
United States Gauge Co., New York.
Walworth Mfg. Co., Boston, Mass.

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Shunk Mfg. Co., Bucyrus, Ohio.

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Cleveland Pneumatic Tool Co., Cleveland, Ohio.
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(See Drills, Hammer.)

HAMMERS, STEAM, PILE. (See Pile Hammers, Steam)

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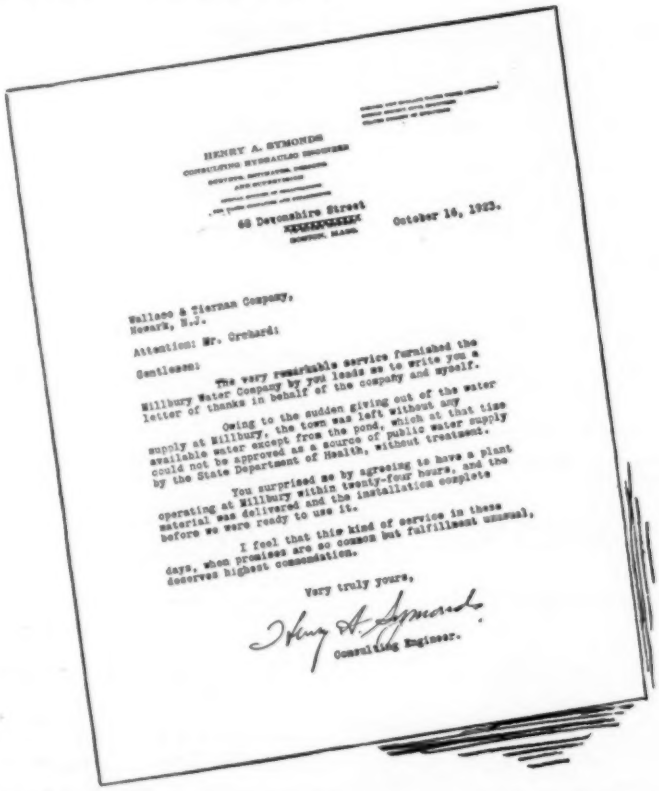
Once More!



HENRY A. SYMONDS
CONSULTING HYDRAULIC ENGINEER

60 Devonshire Street
BOSTON, MASS. October 16, 1923.

Wallace & Tiernan Company,
Newark, N.J.

Attention: Mr. Orchard:

Gentlemen:

The very remarkable service furnished the Millbury Water Company by you leads me to write you a letter of thanks in behalf of the company and myself.

Owing to the sudden giving out of the water supply at Millbury, the town was left without any available water except from the pond, which at that time could not be approved as a source of public water supply by the State Department of Health, without treatment.

You surprised me by agreeing to have a plant operating at Millbury within twenty-four hours, and the material was delivered and the installation complete before we were ready to use it.

I feel that this kind of service in these days, when promises are so common but fulfillment unusual, deserves highest commendation.

Very truly yours,

Henry A. Symonds
Consulting Engineer.

During the current water supply shortage our Service Organization has been called on many times to meet real emergencies. Mr. Symonds' letter is typical of many that we have received. With a Nation Wide Service Organization we are constantly ready to handle emergencies of this nature.

"The Only Safe Water is a Sterilized Water"

WALLACE & TIERNAN
COMPANY, INCORPORATED
Manufacturers of Chlorine Control Apparatus
NEWARK NEW JERSEY

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Weller Mfg. Co., Chicago, Ill.

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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Flory Mfg. Co., S., Bangor, Pa.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
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National Hoisting Engine Co., Harrison, N. J.
Street Bros. Mach. Wks., Chattanooga, Tenn.
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*Pawling & Harnischfeger Co., Milwaukee, Wis.
C. H. & E. Mfg. Co., Milwaukee, Wis.
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Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Clyde Iron Works Sales Co., Duluth, Minn.
Construction Machy. Co., Waterloo, Iowa.
Domestic Engine & Pump Co., Shippensburg, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Lansing Co., Lansing, Mich.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Monighan Machine Co., Chicago, Ill.
Mundy Hoisting Engine Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Novo Engine Co., Lansing, Mich.
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Schramm, Inc., West Chester, Pa.
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Chicago Pneumatic Tool Co., New York.
Detroit Hoist & Machine Co., Detroit, Mich.
Hanna Eng. Works, Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Northern Engineering Works, Detroit, Mich.
Sullivan Mach'y Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

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Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Flory Mfg. Co., S., Bangor, Pa.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Orr & Sembower, Reading, Pa.
Treadwell Eng. Co., Easton, Pa.

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*Rock Mfg. Co., Waterloo, N. Y.
*Wood Hydr. Hoist & Body Co., Detroit, Mich.
(Horizontal Hydr. Hoist Co., Detroit, Mich.)
Perfection Hoist & Engine Co., Two Rivers, Wis.
Van Dorn Iron Wks., Cleveland, O.

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Dee Co., Wm. E., Chicago, Ill.
Delaware Clay Products Co., Pittsburgh, Pa.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
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Metropolitan Paving Brick Co., Canton, Ohio.
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*Ransome Concrete Mchy. Co., Dunellen, N. J.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.
Weller Mfg. Co., Chicago, Ill.

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Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodyear Tire & Rubber Co., Akron, O.
Ingersoll-Rand Co., New York.
Penna Flexible Metallic Tubing Co., Phila., Pa.
Republic Rubber Co., Youngstown, O.
U. S. Rubber Co., New York

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*Goodrich Rubber Co., B. F., Akron, O.
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Fabric Fire Hose Co., New York.
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U. S. Rubber Co., New York.

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Niagara Metal Stamping Corp., Nia. Falls, N. Y.

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*Rensselaer Valve Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Mfg. Co., Waterford, N. Y.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Norwood Engineering Co., Florence, Mass.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

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Rice Hydraulic Engine Co., New York
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Carbondale Machine Co., Carbondale, Pa.
Frick Co., Inc., Waynesboro, Pa.
Triumph Ice Machine Co., Cincinnati, O.
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Vogt Mach. Co., Henry, Louisville, Ky.
York Mfg. Co., York, Pa.

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INDICATOR POSTS. (See Valves)

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*Standard Testing Laboratories, Inc., New York.
Allentown Testing Laboratories, Allentown, Pa.
Conwell & Co., E. L., Philadelphia, Pa.
Gulick-Henderson Co., New York
Hunt & Co., Robert W., Chicago, Ill.
N. Y. Testing Laboratories, New York.
Pittsburgh Testing Laboratories, Pittsburgh, Pa.

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Ainsworth & Sons, Wm., Denver, Col.
Beckman Co., L., Toledo, Ohio
Berger & Sons, C. L., Boston, Mass.
Brandis & Sons Mfg. Co., Brooklyn, N. Y.
Buff & Buff Mfg. Co., Boston, Mass.
Dietzgen Co., Eugene, Chicago, Ill.
Gurley, W. & L. E., Troy, N. Y.
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"Our Best 'Sixty' has revolutionized our cost of road construction and maintenance," writes the engineer of a Colorado County where the Best has been used for pulling scraper, elevating grader, scarifier and snow plows. "In fact, it has never failed in anything we have asked it to do and has been very economical both as to repairs and operation."

SEND for free book which tells how progressive cities are removing snow, and why they find it to their advantage. It's profitable winter work for contracting outfits.

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Weber & Co., F., Philadelphia, Pa.
White Co., David, Milwaukee, Wis.
Wiesler Instrument Co., St. Louis, Mo.

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(See Bridges and Buildings)

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Buda Company, Chicago, Ill.
Duff Mfg. Co., Pittsburgh, Pa.
Joyce-Cridland Co., Dayton, O.
Kalamazoo Railway Supply Co., Kalamazoo, Mich
Norton, Inc., A. O., Boston, Mass.
Rees Mfg. Co., Pittsburgh, Pa.
Templeton, Kenly & Co., Ltd., Chicago, Ill.
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(See Expansion Joint Material)

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Macleod Co., Cincinnati, O.
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Defiance Lantern & Stamping Co., Rochester, N.Y.
Dietz Co., R. E., New York.
Handlan, Buck Mfg. Co., St. Louis, Mo.

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*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Bostwick Steel Lath Co., Niles, O.
Corrugated Bar Co., Inc., Buffalo, N. Y.
General Fireproofing Co., Youngstown, O.
Milwaukee Corrugating Co., Milwaukee, Wis.
Northwestern Expanded Metal Co., Chicago, Ill.
Penn Metal Co., Boston, Mass.
Sykes Metal Lath & Roofing Co., Niles, O.
Youngstown Pressed Steel Co., Warren, O.

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Chadborn & Coldwell Mfg. Co., Newburgh, N. Y.
Coldwell Lawn Mower Co., Newburgh, N. Y.
Gilson Mfg. Co., Port Washington, Wis.
Ideal Power Lawn Mower Co., Lansing, Mich.
Jacobsen Mfg. Co., Racine, Wis.
Penna. Lawn Mower Works, Philadelphia, Pa.
Philadelphia Lawn Mower Co., Philadelphia, Pa.
Townsend Co., S. P., Bloomfield, N. J.
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Leadite Co., The, Philadelphia, Pa.

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Chicago Flexible Shaft Co., Chicago, Ill.
Fecht's Sons, Geo., Hoboken, N. J.
Hauck Mfg. Co., Brooklyn, N. Y.
Smith Mfg. Co., A. P., E. Orange, N. J.

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Niagara Metal Stamp. Corp., Niagara Falls, N. Y.

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Carbic Mfg. Co., Duluth, Minn.
General Electric Co., Schenectady, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.
Macleod Co., Cincinnati, O.
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Prest-O-Lite Co., Inc., New York

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Barber-Greene Co., Aurora, Ill.
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Bonney Supply Co., Inc., Rochester, N. Y.
Chain Belt Co., Milwaukee, Wis.
Conant Machine Co., Concord Jct., Mass.
Economy Excavator Co., Iowa Falls, Iowa.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Lee Trailer & Body Co., Chicago, Ill.
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Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Nelson Iron Wks., Brooklyn, N. Y.
Portable Machy. Co., Passaic, N. J.
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Smith Co., T. L., Milwaukee, Wis.
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Brookville Track & Tractor Co., Brookville, Pa.
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Davenport Locomotive Works, Davenport, Ia.
Fate-Root-Heath Co., Plymouth, O.
Hadfield-Penfield Steel Co., Bucyrus, O.
Lima Locomotive Wks., Lima, O.
Industrial Equipment Co., Inc., Minster, O.
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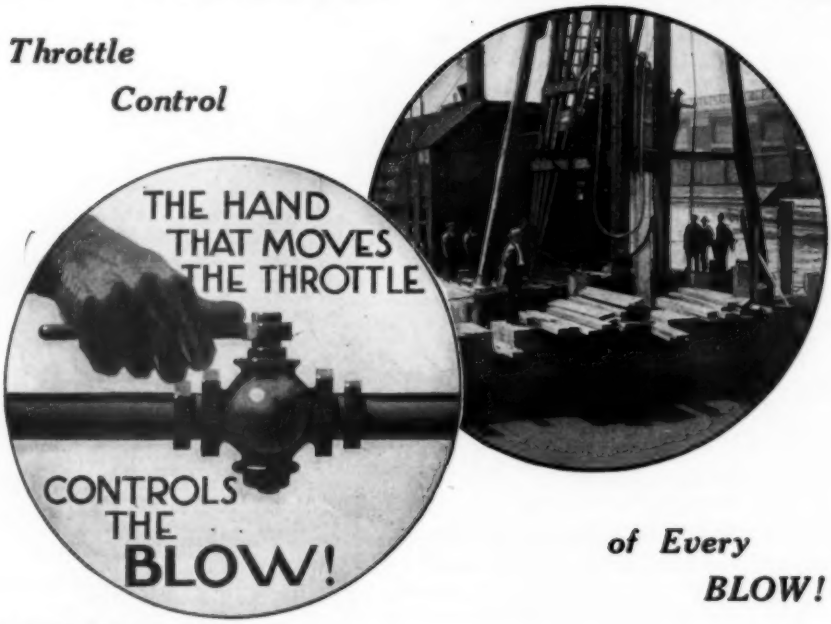
For Concrete Pile Driving

Throttle Control



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You get it with

McKiernan-Terry Hammers

9-B and 11-B Double Acting

At last it is possible to use heavy pile hammers to drive concrete piles—or heavy timber piles—when prevailing conditions seem to indicate loading and jetting as the only method possible.

The throttle control of the blows of McKiernan-Terry 9-B and 11-B concrete Pile driving Hammers permits exact regulation of the velocity, energy and frequency of the blows!

The fact is, the throttle control made possible by these Hammers permits exact regulation of the blow for any size and type of concrete pile and soil resistance.

A touch of the operator's hand on the throttle, and the steam accelerated ram of these big hammers can be made to merely tap-tap on the pile head.

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- Sangamo Electric Co., Springfield, Ill.
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- Builders Iron Fdry., Providence, R. I.
- Cleveland Gas Meter Co., Cleveland, O.

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- *Neptune Meter Co., New York.
- *Pittsburgh Meter Co., E. Pittsburgh, Pa.
- *Union Water Meter Co., Worcester, Mass.
- Buffalo Meter Co., Buffalo, N. Y.
- Federal Meter Co., Brooklyn, N. Y.
- Gamon Meter Co., Newark, N. J.
- Hersey Mfg. Co., Boston, Mass.
- National Meter Co., New York.
- Thomson Meter Co., Brooklyn, N. Y.
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- Lakewood Engineering Co., Cleveland, O.
- Union Iron Works, Inc., Hoboken, N. J.

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- *Koehring Co., Milwaukee, Wis.
- Austin Machinery Corp'n, Toledo, O.
- Kent Machine Co., Kent, O.

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- *Ransome Concrete Mchy. Co., Dunellen, N. J.
- Austin Machinery Corp'n, Toledo, O.
- Blaw-Knox Co., Pittsburgh, Pa.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Construction Machinery Co., Waterloo, Ia
- Kent Machine Co., Kent, O.
- Knickerbocker Co., Jackson, Mich.
- Lansing Co., Lansing, Mich.
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- Cutler-Hammer Mfg. Co., Milwaukee, Wis.
- Fairbanks, Morse & Co., Chicago, Ill.
- General Electric Co., Schenectady, N. Y.
- Holtzer-Cabot Elec. Co., Boston, Mass.
- Lincoln Elec. Co., Cleveland, O.
- Robbins & Myers Co., Springfield, O.
- Wagner Elec. Mfg. Co., St. Louis, Mo.
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- Hinkley Motors, Inc., Detroit, Mich.
- Waukesha Motor Co., Waukesha, Wis.
- Wisconsin Motor Mfg. Co., Milwaukee, Wis.

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- *General Motors Truck Co., Pontiac, Mich.
- *International Motor Co., New York.
- Acme Motor Truck Co., Cadillac, Mich.
- Atterbury Motor Car Co., Buffalo, N. Y.
- Autocar Co., Ardmore, Pa.
- Bessemer Motor Truck Co., Grove City, Pa.
- Brockway Motor Truck Co., Cortland, N. Y.
- Clydesdale Motor Truck Co., Clyde, O.
- Corbitt Motor Truck Co., Henderson, No. Car.
- Denby Motor Truck Co., Detroit, Mich
- Diamond T. Motor Car Co., Chicago, Ill.
- Duplex Truck Co., Lansing, Mich.
- Federal Motor Truck Co., Detroit, Mich.
- Four Wheel Drive Auto Co., Clintonville, Wis.
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- Indiana Truck Corp'n., Marion, Ind.
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- Larrabee-Deyo Motor Tr. Co., Binghamton, N.Y.
- Nash Motors Co., Kenosha, Wis.
- Pierce Arrow Motor Car Co., Buffalo, N. Y.
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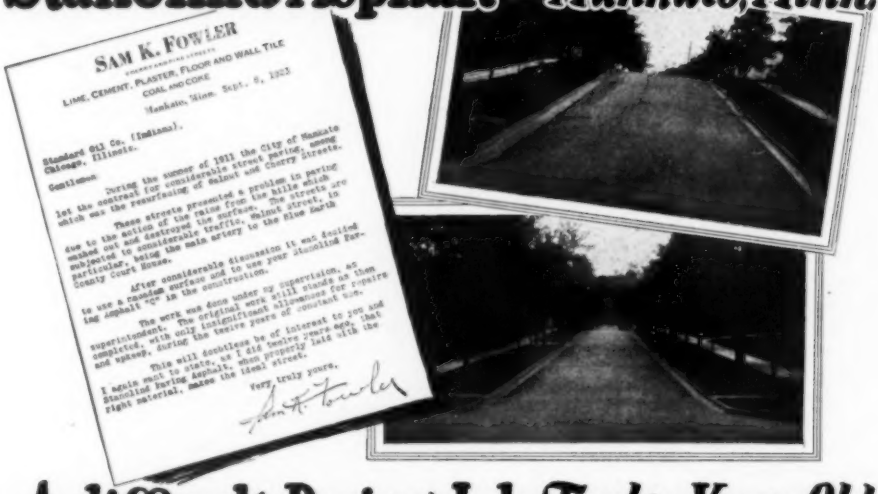
SAM K. FOWLER
LIME, CEMENT, PLASTER, FLOOR AND WALL TILE
COAL AND COKE
Mankato, Minn. Sept. 6, 1923
Standard Oil Co. (Indiana),
Chicago, Illinois.
Gentlemen:
let the contract for considerable street paving, among
which was the resurfacing of Walnut and Cherry Streets.
due to the action of the rains from the hills which
washed out and destroyed the surface. The streets are
subjected to considerable traffic, Walnut street, in
particular, being the main artery to the Blue Earth
County Court House.
to use a macadam surface and to use your Stanolind Pav-
ing Asphalt "C" in the construction.
superintendent. The original work still stands as then
completed, with only insignificant allowances for repairs
and upkeep, during the twelve years of constant use.
I again want to state, as I did twelve years ago, that
Stanolind Paving Asphalt, when properly laid with the
right material, makes the ideal street.
Very truly yours,

A difficult Paving Job *Twelve Years Old*

MANY difficult paving problems have been met and mastered by the practical men who are familiar with the many excellent qualities of Stanolind Paving Asphalt. The letter shown above from Mr. Sam K. Fowler tells how one such problem was solved. You will be interested, we know, in reading it.

Perhaps you do not have the same kind of a paving problem to meet as Mr. Fowler met so successfully twelve years ago. A pavement, however, which withstands so long the rigorous conditions Mr. Fowler describes, will certainly give service under ordinary conditions.

Your problem may be to provide a pavement which will stand up under hard, gruelling traffic. According to this letter, Walnut and Cherry Streets "are subjected to considerable traffic" yet "the original work still stands as then completed."

Weather conditions in your territory at certain times may be so severe that ordinary paving materials will not withstand them successfully. These streets at Mankato, paved with Stanolind Asphalt, have been through twelve severe Minnesota winters and are still in good condition.

Of course, you desire to keep the cost of upkeep on your roads as low as possible. Regardless of the heavy traffic and the severe weather, the roads built with Stanolind Paving Asphalt had only "insignificant allowances for repairs and upkeep during the *twelve* years of constant use."

Whatever your paving problems may be, you will find that Stanolind Paving Asphalt will prove as satisfactory to you as it has for other users. Ask any of them their opinion of Stanolind Paving Asphalt, and they will tell you that its low maintenance cost, low initial cost of laying, and long life make it the ideal paving material.

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Cleveland Pneumatic Tool Co., Cleveland, O.
Hanna Eng. Works, Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Watson-Stillman Co., New York.

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Dunbar Drop Forge Co., Chicago, Ill.
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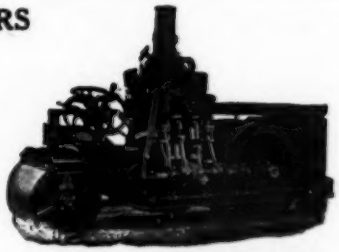

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Industrial Works, Bay City, Mich.
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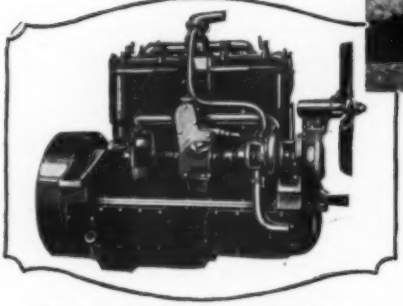

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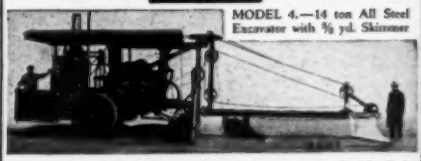

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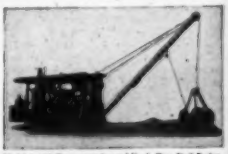

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Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
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Biggs Boiler Wks., Akron, O.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
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Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Pittsburgh, Pa.
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Tarrant Mfg. Co., Saratoga Springs, N. Y.

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*International Motor Co., New York.
*Municipal Supply Co., South Bend, Ind.
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Etnyre & Co., E. D., Oregon, Ill.
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Tiffin Wagon Co., Tiffin, O.
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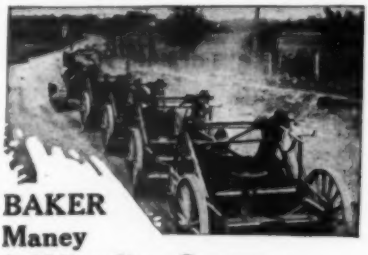

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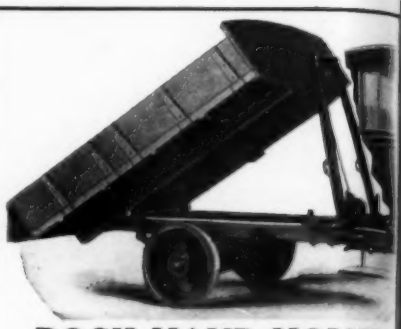

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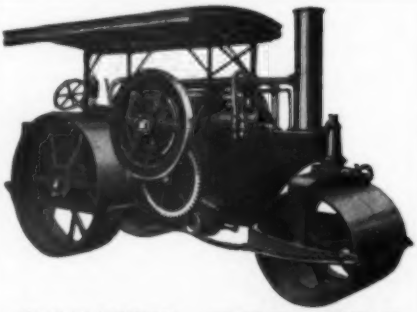

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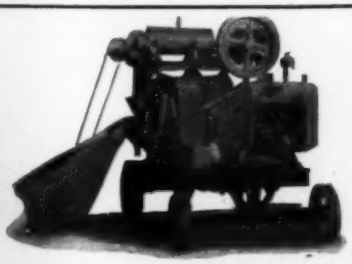

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Construction of Low-Head Dam for Power at Monticello, Ind.

Indications of the Water-Power Developments of the Future Point to Added Projects on Commonplace Rivers of the Plains by Low-Head Dams

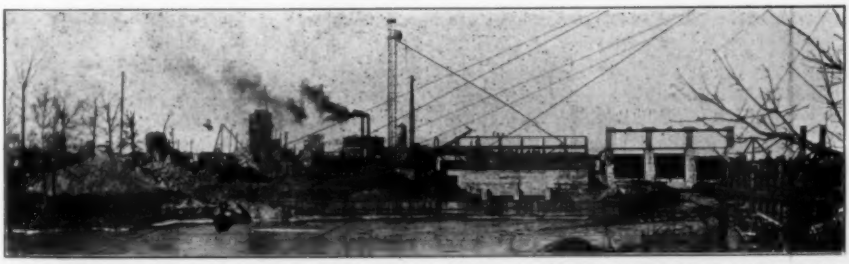
By Rowland R. Manatt
Chief Engineer for Mansfield Engineering Company on the Norway Development

WATER-POWER development has progressed to the point where dams of low heads have been found practical, and their necessity felt. A hydro-electric plant of this type, known as the Norway Development, is being built along the Tippecanoe River at Monticello, Ind., by the Mansfield Engineering Company, of Indianapolis. The project, which involves an investment of one million dollars, is being constructed for a subsidiary of the Western Utilities Company, and the plant, when completed, will have a maximum output of 8,400 kv.-amp. The generated current will be sent to a central steam power-plant in Illinois, there to be combined with the power received from other developments and then distributed to the various places of market. This is done so that during low-water stages, when the supply from the various dams owned by the company does not equal the desired amount, the steam plant can be turned on to balance the supply and demand.

Upon reaching the job, the first thing of vital importance was to prepare for the construction plant along the banks of the river. In lieu of an available railroad, the first batches of material were trucked out from the nearest supply 3 miles away. This sufficed for the offices, the storerooms, and the skeletons of several of the heavier structures. In the meantime, a temporary spur was being brought in 3 miles from the main line. Upon its completion, trainloads of equipment and materials were hurried in. Large steel derricks were first unloaded and erected so that the materials could be more easily handled and stored.

Coffer-Dam of Native Logs

In a short time, the system of coffer-dams was under construction. As the river bed at



GENERAL VIEW OF THE WORKING END OF THE DAM, SHOWING THE POWER-HOUSE AND FLOOD-GATES WITH MOST OF THE CONSTRUCTION PLANT AND THE STEEL FRAMEWORK FOR THE POWER-HOUSE IN PLACE

this point is exposed solid rock, it was out of the question to drive any piling or sheeting. Since 1,200 acres above the dam had to be cleared of all timber, the clearing was drawn on for the coffer-dam framework. Native logs were formed into bents and pushed ahead, a bent at a time, until a wooden trestle stretched completely across the river on a line parallel to and about 20 feet up-stream from the face of the future dam. Then plank sheeting was gradually built out on each side of the open trestle, with dirt filling following closely behind the advancing sides. The dirt was brought out on the trestle by a dinky locomotive, and the loads dropped down between the completed siding. This procedure was continued until one-half the channel was shut off. The coffer-dam was then turned down-stream and finally back to shore, leaving a dry area in the old river channel. This coffer-dam has the feature of being self-draining; that is, the lower end is so much lower than the upper end that a sluice-gate opening has been left in it, so that any overflow of flood water will drain out naturally without the use of pumps.

As soon as the coffer-dam had turned the water from the one side of the channel, the engineering corps started laying out the working points that were later to guide the construction of the dam proper. Everything was located by coordinates referred back to the two original base lines established by the consulting engineers of the power company. The contractors' more important points were located on the tops of iron pins permanently grouted into holes drilled in the solid rock. As nearly as possible, permanent points were set so as to give a network of definite transit lines the intersection of which would locate any of the major points required. To clear the lines of sight from the construction work, a system of reference points was placed on top of the coffer-dams. Even such a substantial structure was later on found to move slightly, thus making all the reference points useless. The field engineer must keep constantly on the alert in order to succeed in maintaining his established lines and to keep his work laid out always in advance of the oncoming construction gang.

Materials Available at Site

During this period of preparation the materials plant was being constructed. The adopted system provides that all the materials but cement are to be found on the reservation itself. As the river had to be deepened below the dam site to form a tailrace for the water to be discharged from the power-house, it was decided to fill two items of the contract with one major operation—to remove the gravel and rock from the tailrace and then return it in the form of concrete. Three dragline outfits, consisting of Pioneer back-dump buckets made by the contractor, were set up to draw the gravel from the upper half of the tailrace and to carry it in relays to the sand and gravel washing plant. There it was washed, screened and separated into either sand or gravel bins. A long Jeffrey belt conveyor, electrically driven, then carried it to the storage piles, from which a clam-shell derrick fed it as needed into the material bins. The entire upper half of the tailrace excavation was through solid rock, the rock removed being carried in stone skips to the stone crusher and then crushed. A continuous line of cement was carried by means of a belt conveyor to the mixing plant. The battery of two mixers, one 1-yard Ransome and one ¾-yard Smith, was placed below the material bins and received the measured materials from the Blaw-Knox batchers fed by gravity from the bins. Most of the concrete was of a 1:8 mix, but all of the power-house

DOWN-STREAM SIDE OF SPILLWAY NEARLY COMPLETED

Shovel is shown cleaning up the down-stream side of the spillway, and fish ladders almost completed. The illustration also shows the earth embankment on the down-stream side of the core wall

concrete was of a 1:6 mixture, the different mixes being obtained by adjustment of the batchers. Both mixers were arranged so as to discharge into concrete cars, which were then hauled in trains across the coffer-dam and swung by derricks to the final place of discharge. One mixer was also fitted to turn its output into the Lakewood tower hoist bucket as well as into the cars. The chuting system was composed of the main steel tower, 150 feet high and situated at the mixing plant, and a 90-foot wooden tail tower built on the other side of the river. The two towers supported a suspension cable running lengthwise of the works so as to best cover the job with the suspended line of Insley chuting.

With the equipment all in place, the construction plant ready to operate, and the engineering layout completed, the actual construction work was started. The plans for construction provided that the power-house, flood-gates, end sections of the spillway and the two end core walls be constructed by use of the original system of coffer-dams, thus allowing the water to pass through only one-half of the original channel. On the completion of that much, the coffer-dams were switched so as to swing the river back to the other side of the stream bed and through the open flood-gates in the completed part of the dam, leaving the opposite side of the river dry for the completion of the spillway and the dam as a whole.

Rock Excavating

The first work to be done of a permanent nature was the rock excavation required in preparing the foundations for the structure proper. The wheel pits for the power-house were sunk 18 feet into the solid rock. All the concrete was built into a solid rock footing, with the result that the structure is as solid as the earth itself. In aggregate, 13,500 cubic yards of rock were taken out, and a large percentage of it was returned to the river in the form of concrete. Most of the excavation was done by means of drilling and shooting. Indiana limestone breaks up nicely when properly drilled and lightly shot. The drilling was done by large Sullivan tripod steam drills or small air-operated jackhammer drills. For finer work, the rock was removed by "channeling"; that is, a row of holes was drilled so closely together that rock would break off evenly along that line. The looser ledge rock was removed by barring and wedging, with a steam shovel dipping in occasionally.

As soon as the foundations were prepared, the carpenters were given their turn at the work. The carpenter gangs erected the concrete forms, and when they were completed, thoroughly braced from the outside, tied together from the inside, and checked for line and grade by an engineer, everything was in readiness for pouring the concrete. In many of the forms the concrete was placed by both the chutes and the derricks at the same time. The more scattered units were generally poured by the derricks, while all the higher and nearer sections were filled by the chutes. About the only manual labor required in the concreting was for moving the chutes and for tamping the concrete in the forms. In this case, where unusually large aggregate was used, some as long as 12 inches, considerable tamping and spading was necessary to avoid honeycombing in the concrete. Each pour keyed off so as to fit snugly into the succeeding pour, thus giving a stronger and more water-tight construction joint. In the core walls an asphalt coating was used for an expansion joint, but no provision was made for expansion in the bulkier portions of the dam. All exposed concrete surfaces were finished upon removal of the forms by rubbing with carborundum bricks or electric grinders and then painting with neat cement.

As is customary on such projects, special phases of the work were sublet to other contractors. The S. Morgan Smith Company, of York, Pa., is furnishing and installing the four turbines, and Westinghouse will attend to the electrical installations and furnish the four generators and the switchboard. The turbines are of the modern Francis type of runner, 66 inches in diameter, being a bit larger than the usual installation. Their design calls for a head of 30 feet, speed of 120 r. p. m., and a power output of 2,300 kv.-amp. apiece. Each turbine will drive a separate generator, which is to be mounted on the upper end of the wheel's drive-shaft.

Unique Method of Dismantling

The construction work will be completed in a few more months and then the no small job of dismantling the construction plant will be started. The different construction units will be drawn from the outer ends in to the derricks, just as they were originally built by spreading out with the derricks as the starting centers. The coffer-dams will be torn out, the trestles knocked down, the buildings razed and all the scrap lumber piled up ready for the auction block, the better material being sent on to the next job. Gradually the water-tanks, boilers, shops and storerooms will be drawn into the all-consuming outlet of disposal. At last nothing will be left but the two derricks, and then they must dismantle each other.

Upon the removal of all equipment, either to the next project or to the store yards, the entire reservation will be graded and finished off in accordance with some pleasing landscape scheme by the remaining teams and tractors. Drives will be built, embankments grassed and everything made attractive for the crowd of summer home-seekers that will surely come to such a beautiful lake.

ACKNOWLEDGMENT.—From a recent article in *Iowa Engineer*, Ames, Iowa. Photographs by courtesy of the author.

The Obligations of the Contractor on Public Works

HERBERT NUNN, General Manager, Contractors' Association of Northern California, has discussed this subject in a very interesting manner in the *Pacific Street and Road Builder* and has brought out how the contractor has met the changing demands on his resources. The public knows very little of the economic position occupied by the contractor relative to public works. Public welfare demands that full value be received for all moneys derived from, and expended for, the public. Economical construction is the key to the situation. The general contractor, with his efficient organization and specialized equipment, is now giving excellent service and is devoting much time and energy to the reduction of costs and to improving his work.

Within the last few years stupendous sums of money have become available for public construction—an amount of money that a few years since would have seemed appalling. To meet the public demand for improvements has taxed the resources of contractors to their limits. The contractor, because of his versatility, due to working under constantly changing conditions, has met the situation and in a marvelously short period of time has adapted his organization and equipment to the increasing demand. Labor became scarce and inefficient, and transportation service either failed or became woefully deficient, conditions all of which tend to increase the cost of public construction to a prohibitive figure.

In order to secure the cooperation of all the general contractors, the first step naturally was to form an association, and contractors in various districts have done so. Competition among contractors is keen, but there are many problems which they have in common, and, working on this basis, they were enabled to adopt constitutions which, in brief, are covered by the following paragraphs:

To cooperate with public bodies and private owners, their engineers and representatives in the performance of better construction.

To maintain high standards of efficiency and sound business methods and to make membership a responsible assurance to the public of skill, honesty and responsibility.

To effect economies in construction through cooperative action in matters pertaining to materials, supplies, labor, insurance and bonds.

Cooperation with Public Bodies

Specifications for public works now vary greatly in different districts, and while it is neither possible nor desirable to standardize public construction, it is desirable to standardize and simplify specifications so as to remove all doubt as to what the contractor is expected to do. With the removal of these hazards will come a corresponding reduction in cost to the public. Publicity through meetings with county engineers, county supervisors and public bodies has done much toward removing criticism of public officials and contractors due to misinformation on the subject.

The Labor Situation

The labor situation has been one of the contractors' major problems. A rapid turnover in labor means a high overhead cost, due to the necessity of constantly transporting men, and leads to inefficiency, because the men do not remain on the work long enough to become familiar with their duties. All of these costs will eventually reach the taxpayer. Contractors have done much to remedy this condition by the introduction of labor-saving machinery. This results in a higher-paid and skilled personnel and offers opportunity to a man who is ambitious. To reach a high standard of efficiency it was necessary that sound business methods be introduced and that these methods be standardized to a certain extent. For this purpose contractors have installed cost distribution systems. This method of analyzing costs gives the contractor a daily check on his expenses and enables him to eliminate waste. It also enables him to place before his bankers a concise statement of his financial condition. A good business statement enables a contractor to finance his work on a more economic basis. The public eventually will receive the benefit.

Insurance and Bonds

On all public works the contractor is required to furnish a bond, the cost of which is passed on to the public. Under the state laws, contractors are also required to carry workmen's compensation insurance. It has not been possible up to this time for contractors to reduce the cost of surety bonds, but the Contractors' Association of Northern California has formed an insurance company, known as the Contractors' Indemnity Exchange of California, for the purpose of carrying their own compensation insurance. This has resulted in a direct saving and an indirect saving which cannot be estimated. The fact that the contractors are writing their own insurance brings home to them the necessity of preventing accidents, and on their individual jobs they have endeavored to eliminate all the ordinary hazards. From a humanitarian standpoint, this is a splendid achievement, and it has an economic value that is very real.

Cooperation

Cooperation between contractors through the exchange of general information has resulted in the introduction of newer and more efficient methods throughout. This cooperation has also resulted in a friendly feeling between competing firms and has enabled contractors to exchange and rent equipment from each other. This often results in a direct saving because it enables contractors to obtain equipment locally.

Smokeless Shovels Operate in Residence District

Compressed Air Runs Steam Shovels on Cleveland Water Extension

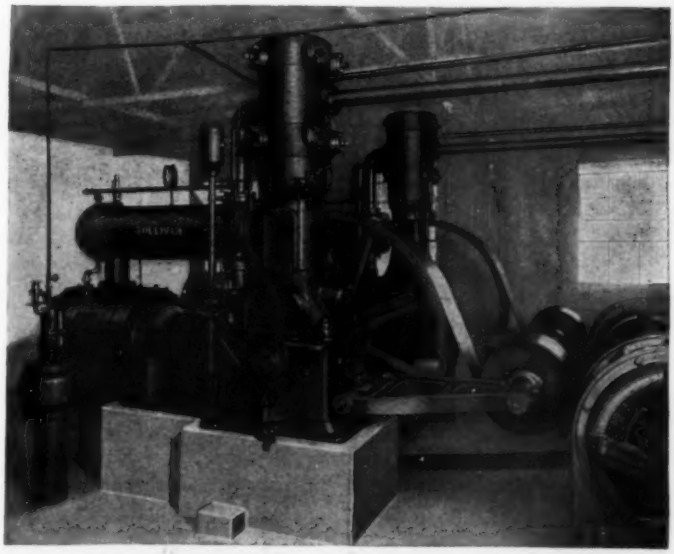
THE adaptability of compressed air to various angles of construction work recently found an interesting application in Cleveland in the laying of several miles of water intake mains from the Kirtland pumping-station to the new Baldwin reservoir and purification plant in the highest part ofthe city. The intake consists of two 5-foot Lock Bar steel pipes laid side by side in a trench 15 feet wide, the depth varying from about 9 feet to 20 feet, according to the contour of the surface. For about 6,000 feet the mains run through Wade and Rockefeller Parks, which are contiguous, consisting of a long, narrow parkway transversing one of the finest residence sections of the city and crossing several heavily traveled streets.

It was felt that the work should progress rapidly, with as little obstruction to street traffic as possible, but, at the same time, A. B. Roberts, Director of Utilities, decided that care should be taken to avoid defacing the residences and public buildings along the route. He decided not to permit the use of steam equipment in the parks, in order to avoid damage from smoke and soot As the work was prosecuted day and night, it was also necessary to avoid the noisy exhaust from steam engines.

It was found that by installing an air compressor plant this result could be accomplished,

VIEW OF COMPRESSOR POWER-HOUSE, SHOWING AIR INTAKE

while the contractor could utilize standard excavating equipment which can be used on future work where steam is not objectionable. Peter F. Connolly of Boston, Mass., the contractor, installed two Sullivan angle-compound belt-driven air compressors having a rated capacity of 784 cubic feet per minute at 250 r.p.m., which supplied an abundance of air at 125 pounds pressure. Each compressor was driven by short belt connection from a General Electric, 220-volt, 3-phase slip-ring motor of 150



ANGLE COMPOUND COMPRESSORS, WADE PARK WATER EXTENSION, CLEVELAND

ONE OF THE AIR-OPERATED DRAGLINES MAKING THE SURFACE CUT, IN WADE PARK

HOW THE STEEL MAINS WERE LAID

horse-power. The air intakes were led under the floor to the outside of the building and were hooded over to prevent foreign matter from entering the cylinders. The alternating current for the compressors was supplied by the Cleveland Electric Illuminating Company, special transformers being installed just outside the building. From the compressor house a 6-inch main led about 4,000 feet north, and a 4-inch main for 3,600 feet in the other direction along the trench. These mains were equipped with numerous tees for machine connection.

The excavators consisted of three Erie Model B shovels mounted on sectional track with interchangeable boom equipment. In accordance with the necessities of the work, they were used as steam shovels, dragline excavators, clam-shells, or cranes for placing pipe. A Keystone excavator was used for back-filling the trench after the pipe was laid and tested.

An ingenious method was used for furnishing the air power to the machinery. Two-inch hose connected the shovel to the main. It was led through one of the openings in the side of the sectional track and was connected with the hollow swivel pin on which the shovel revolved. Thence it ran into the boiler and there was reheated by means of a light wood fire in the boiler.

Considerable rock was encountered and drilled with hand hammer drills of the self-rotating type. In the hard-pan, compressed-air spades with long handles were found very useful. For tamping the fill solidly under the pipes, compressed-air tamping tools or sand rammers were used. On the 6-inch line a water trap was installed at a low point for the purpose of drawing off accumulated moisture before delivery to the shovels and drills.

As the work progressed both day and night, proper illumination was important. A number of locomotive-type steam turbine generators furnished the current to 150-watt incandescent lamps. These turbines were light enough to be handled by two men, required no foundations, and ran excellently on compressed air. They were placed wherever needed along the line and connected to the air main with ¾-inch hose. In addition, each shovel was equipped with a generator on the roof.

The work was continuously under the personal supervision of A. B. Roberts, Director of Utilities, city of Cleveland; A. V. Ruggles, Commissioner of Water; G. W. Bowers and F. R. Sullivan, Assistant Engineers in direct charge of the work.

AIR-OPERATED SHOVEL IN THE CUT

LEGAL POINTS FOR CONTRACTORS

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

Liability of Contractors' Sureties

Under a bond to secure faithful performance of a building contract which permits changes or additions to be made as the work progresses, the surety was discharged by a change in plans, without his consent, whereby the building was extended from seven stories to eight. In so holding in the case of Lamson vs. Maryland Casualty Co., 194 Northwestern Reporter, 70, the Iowa Supreme Court said:

"The law is well settled that, where a surety company, for a consideration, enters into an undertaking to guarantee the faithful performance of a builder's contract which provides that changes, alterations, and additions may be made in the building, the bond is not invalidated by changes or additions made in accordance therewith. . . . Also, that the contract of a paid surety is construed most favorably to the party for whose benefit it was executed. . . .

"What changes or deviations from the original plan of the building or additions thereto are authorized by the contract? It is a matter of common knowledge that changes and alterations of a more or less material character are usually made in the erection of buildings large and small. Sometimes they increase, and again they may reduce, the cost of the structure. The contract clearly authorized deviations of this nature. It seems to us, however, that the change from a seven- to an eight-story building was more substantial than the parties contemplated by their contract."

Employer's Liability for Negligence of Worker Toward Co-Employee

In Missouri, as well as other states, an employer's liability, in a personal injury action, for injury sustained by one employee through negligence of another may depend upon whether the employer has been guilty of negligence in retaining the employee at fault. This involves a qualification of the general rule in force in those states—known as the "fellow servant rule"—that an employer is not liable for injuries due to carelessness of co-employees.

In the recent case of Burns vs. R. L. McDonald Manufacturing Co., 252 Southwestern Reporter, 984, plaintiff sued for damages for injury sustained through falling of a joist upon him while he was working on a building for defendant. The accident was due to carelessness of another employee. In disposing of the case, the Court said:

"It is no doubt true that, in order to render a master liable on the ground defendant is herein sought to be held, the negligence of the servant "must be habitual, rather than occasional, or of such a character as to render it imprudent to retain him in service. The character of carelessness cannot be proved by a single act of negligence. Furthermore, the master cannot be held liable for retaining a habitually careless servant, unless the injury is shown to be connected with or caused by the faulty trait in the servant. And knowledge, either actual or constructive, of such faulty trait or habit must be shown against the master; mere proof that the servant was incompetent and that the plaintiff was injured does not raise an inference of negligence against the master in that regard."

Newspaper Libel Against Public Contractors

To falsely accuse a contractor of charging a county for negligible services and of having put in bad roads is actionable libel, as tending to injure him in his business, held the California Supreme Court in the case of Stevens vs. Storke, 216 Pacific Reporter, 371. The Court noted mere criticism of public work is a matter of such public concern as to be privileged. But it was ruled that the remarks complained of were defamatory and actionable because directed at plaintiff personally.

Liability for Delayed Delivery of Construction Materials

Where sellers of tile unreasonably delayed delivery of the same to the buying contruction company they became liable for damage sustained by the company, by way of additional cost of using brick instead of tile during the period of delay, cost of maintaining construction crews during that period, and the price of tiling left on hands on account of substitution of brick. It was so decided by the Arkansas Supreme Court in the case of Bates vs. Steininger Construction Co., 252 Southwestern Reporter, 618.

The contract required delivery within sixty days and the Court held that failure to deliver until six months afterward was unreasonable.

The sellers attempted to justify the delay under a clause of the contract exempting them from damages on account of delays caused by "strikes, fires, accidents, and acts of Providence, and general conditions beyond seller's reasonable control." The Court decided that the language did not justify the interpretation that the sellers "should be allowed to await their

own convenience to furnish the material. The words 'general conditions beyond seller's control' refer to the class of obstacles described in the preceding language, such as strikes, fires, accidents, and acts of Providence. If the contract is to be construed in accordance with the contention of appellees [the sellers] they were not bound to ship the material unless they could procure it for that purpose, and then it was lacking in mutuality and was not binding on either party, for that would be, in effect, making the delivery of the material optional with the seller."

Latitude Permitted by Right Reserved to Alter Work

A contract for the construction of a dam on a straight-line axis provided that the company for which the work was being done might order "such reasonable alterations, omissions, additions or substitutions in said plans and specifications as the company may deem necessary," etc. Interpreting this clause in the case of Snow Mountain Water & Power Co. vs. Kraner, 216 Pacific Reporter, 589, the California Supreme Court decided that, under the circumstances, an order requiring completion of the dam on a 44-degree angle was not unreasonable. In the course of its opinion, the Court said:

"One of the noticeable features throughout the contract is the evident intention of the parties to vary the plan of construction of the dam. It is obvious that in a work of the nature and magnitude of the proposed construction, the highest engineering skill, even when exercised with utmost care, could not learn in advance all the physical conditions to be met with during the progress of the work. Those to whom the undertaking was intrusted, even with the aid of expert engineers, could not be expected to know in advance all along the line of operations what nature had placed beneath the surface of the earth in the form of obstacles to construction. Alterations and changes, many slight and some substantial, would almost inevitably be required at certain points in a work of such nature. Prudence on the part of those in charge would compel them to make provision for such contingencies as could not be foreseen with ordinary care and prudence. This was the object of the clause inserted in the contract, which should be so construed as to effect its important purpose. The various alterations ordered by the respondent and carried out by the appellant without objection, and the final change ordered to be made from a straight-line axis to the angle of 44 degrees, were all in conformity with changing conditions. If reasonable, they were clearly within the scope of the object and the plan."

Merely Making Contract Does Not Constitute Doing Business in State

New York, like most, if not all, of the other states, forbids the doing of business within the state by a non-resident corporation without obtaining a certificate from the state. This New York statute was invoked before the Appellate Division of the New York Supreme Court, in the case of Odell vs. City of New York, 200 New York Supplement, 705. The Court decided that the act of a construction company, organized under the laws of another state, in merely entering into a contract for work in New York did not constitute a doing of business in the state. It appeared that the proper certificate was filed before the work was executed, and that was held to be sufficient.

The Near-sighted Contractor

THE *Weekly News Bulletin* of the Omaha Builders' Exchange recently contained a fable with a perfectly good moral involved. No one can blame a sub-contractor for getting a "little riled up" when a general contractor rejects the sub-bids upon which he based the bid that captured the job, and goes bargain-hunting for still lower figures. A good many successful general contractors have openly condemned this practise, and abjure it as being distinctly unfair to the sub-contractor, and all of them ought to do so. E. H. Brown, Secretary of the Omaha Builders' Exchange, relates his fable as follows:

Once upon a time there was a near-sighted contractor who was asked by an architect to figure a schoolhouse in the village of Podunk.

And he took the plans and he went over them carefully, and he gathered around him all the sub-bidders he could. And he examined all the figures of those sub-bidders and partook largely of their advice and counsel as to their particular part of the work.

And when all was said and done, he took those sub-bids which seemed best and put them on his estimating sheet and made his bid. And, lo and behold, the next day he had a contract!

Then those sub-bidders who knew their figures were best went to the near-sighted contractor to secure their share of his good fortune. But he refused, saying: "There was a man from Squashton here who promises me a better price. Of course, I know he did not figure the job before it was let, but I took this work on a close margin and if I can save a dollar any place I must do so."

And the sub-bidders went away with wrath in their hearts, for they knew that it was not only their price, but the information they had given, which had enabled the near-sighted contractor to land the job.

And, after many days, this same near-sighted contractor was very desirous of securing another job, and he besought the sub-bidders for bids, but they would have none of him, and he was sore distressed, and went away mournfully, for in his heart he knew he had need of their knowledge and figures if he was to land the job.

And great was his sorrow when he learned that the contract had been awarded to a contractor who played square with his sub-bidders.

The Story of One of the Largest Contracting Organizations in America---Part II

"No Job Too Large, No Job Too Small, No Job Too Difficult" Has Been the Business Creed of the Ley Brothers, Famous Builders

By Merle Crowell

Harold Ley, the Pioneer Cost Analyst

IN 1897 Harold Ley joined the firm, relieving his elder brother of some of the burden of management. His practical schooling in the actuary's office of the insurance company had trained him to analyze figures and to carry every finding to the ultimate accuracy of a sixth or seventh decimal point. This training he put to excellent use.

All construction work at this time was handled in a peculiarly haphazard fashion. The most prosperous contractor was the "best guesser"—the one who could size up a proposed job with a sure eye and tell approximately how much it would cost to "swing" it. But not until the job was nearing completion could he find out whether his estimate had been right or wrong.

Before he traveled far in this new field, Harold Ley decided that a construction job could be analyzed as soundly and figured as finely as any other business enterprise, and that there was no reason why a contractor should not know his exact financial status at any stage of a given contract. During the next two or three years, he worked out a scientific system of cost analysis and put it into application. This system, of which Ley was the pioneer, is now in general use.

Within the next few years the firm not only built street railways in all parts of New England, but it branched out into water-works, dams, bridges, highways, telephone and transmission lines, and construction projects of all kinds. A third and younger brother, Leopold, was beginning to make himself felt in the organization. He is now Vice-President and in charge of all the contracts in the New England States, as well as important work elsewhere.

"We took the slogan, 'No job too large, no job too small'—we have it to-day," Harold Ley explained to me. "At the same time that we are building a skyscraper or an industrial city we may have a group of men patching up the sidewalk in front of the home of one of our old neighbors in Springfield. The folks up there got used to our doing that kind of work in the old days, and we don't want 'em to think that we have outgrown them."

"But didn't you boys, with no technical training of your own, have a lot of nerve in handling such a raft of highly technical engineering jobs?" I asked.

Ley slung one long leg across the other, while his blue eyes twinkled.

"Heavens, man!" he said, "don't you know that good engineers can be *hired* in droves. The woods are full of men with excellent technical training. We have never turned down a job because we knew nothing about it; instead, we went out and hired the men who *did* know.

"It's not technical training that is hard to get hold of; it's *common sense*. The man who uses his head to think with, who can size up any situation and *know* what to do, who will make your problems his own and work day and night to help you solve them—that man is the only rare game one has to stalk, and he can command almost any salary. If he also has the ability to harness handicaps and make them work for him he comes pretty close to having a complete equipment.

Building the Organization

"When Fred was working on that Plymouth job he told you about, an Italian boy, eleven years old, came to him for a job. The little runt couldn't speak a word of English, but through another Italian Fred learned that his name was Angelo Morris, that he was a 'good American' (this very proudly), and that he would work like the dickens if he only had a chance. Fred gave him the job of water boy.

"Thus started the career of perhaps the most remarkable man I have ever known. As a water boy he was a jewel; but he didn't stop there! Eagerly watching the men at work, he learned how to tell instinctively when they wanted some tool, and he was on the run to get it for them before they could ask him. That kid was never still.

"In our street railway venture he made himself invaluable. When he was put in charge of a hydraulic punching machine, we ran across him on the job at eleven o'clock at night, punching holes in the next day's supply of rails.

"By the time he was seventeen he was boss of a gang. Before he was of age we had him in charge of bridge and culvert work. He studied every job in every operation—and worked at it himself until he knew all about it. And he won the devotion of his men by never asking them to do anything that he couldn't and wouldn't do himself. More than once I've seen him ruin a perfectly good suit of clothes by getting up to his neck in mud to help iron out some kink in the job.

"Always that head of his was working overtime. Almost without schooling, he absorbed the technical end of the game so thoroughly that after a time we would just as soon take

BEGINNING THE CONSTRUCTION OF AN APARTMENT HOTEL AT 12 EAST 86th STREET, NEW YORK CITY

This photograph, taken January 22, 1923, shows the footings in place. The apartment hotel has 321 apartments with kitchens, or a total of a little over 1,000 rooms with 420 bathrooms. There are 6 elevators in the building. This building occupies the entire block on Madison Avenue between 85th and 86th Streets, running back about 220 feet on each street

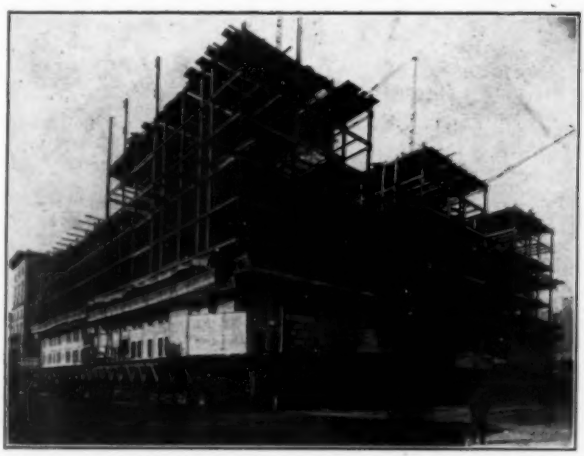
his guess as the labored blue-print of a college-trained engineer. And with plain, old-fashioned 'horse-sense' he was forever arriving at solutions by methods taught in no engineering college between Copenhagen and Cape Town.

"I recall that we once took hold of a difficult water-works job outside of Springfield. A New York firm had gone broke trying to swing it. We picked it up just where they had dropped it and at the price named in their contract. We put Morris in charge and turned our attention elsewhere.

"The tough part of the job lay in the erection of a 100-foot dam at the bottom of a 500-foot gorge, with its sides so steep that only by a most circuitous trail could one reach the bottom at all. The previous contractors had tried to set up a crushing machine in the bottom of the gorge and then to blast rock out of the walls of the gorge to be crushed into the sand and gravel necessary for the cement. To add to the expense of the operation, coal for the crusher had to be hauled ten miles and brought down to the bottom of the gorge.

"Morris studied the situation and then started poking around the land near the top of the gorge. Presently he uncovered an excellent natural gravel pit. Coming back to the gorge, he ordered two chutes built from the top to the bottom—one chute a few inches below the other, and the bottom of the upper chute made of a heavy wire netting—something like the bottom of the jigger through which we American householders sift our coal ashes.

"As soon as the chutes were built he had the gravel gouged out with a clam-shell shovel, carted over to the gorge, and dumped into the upper chute. As it swished down, the fine sand was sifted through into the chute underneath, and at the bottom both the sand and the gravel were shot by the force of gravity to the places where they were needed for mixing



PHOTOGRAPH TAKEN MARCH 17, SHOWING THE STEEL WELL UNDER WAY AND BRICK AND STONE WORK STARTED

The quantities of material used on this job are approximately as follows: 25,000 yards of excavation, practically all rock, 3,400 tons of steel, 200,000 back-up tile, 1,250,000 face brick and 1,000,000 common brick

the cement for the dam. Just by common sense Morris had capitalized a natural handicap."

"What is Morris doing to-day?" I asked.

"Oh, didn't I tell you? He's our *General Superintendent.*"

A Satisfied Customer the Best Advertisement

"It strikes me that success came to you fellows pretty rapidly," I remarked, after a short pause in the conversation. "What was the biggest single factor in it?"

"That's a bit difficult to answer," Ley said, "but I suspect it was the way Fred stuck eternally to the principle that 'the customer is always right.' He applied to the contracting game the same idea that a few big stores and hotels had started to adopt, and he carried it to lengths which, at first, I used to question.

"Sometimes I felt that the man who gave us the contract was demanding much more than he should expect. I was inclined to stand up for our 'rights.' Fred always overruled me, however.

"'A satisfied customer,' he'd say, 'is the best advertisement a company can have. If it comes to a choice, I'd rather have a superintendent come off a job with a letter expressing the owner's satisfaction at the way we've handled things than to have him bring away a profit and leave a disgruntled customer.'

"The rate at which our business grew surely indicated that he was right. To-day, looking back over all our operations, I can see dozens of monuments to the wisdom of this policy. When a piece of work is finished, you can never tell by looking at your books whether it was a good job or not. The books may show a handsome profit; but if the man for whom you did the job is 'knocking' you for years it's likely to be the costliest job you ever put through.

"Moreover, fairness is bound to beget fairness. Few people will take advantage of a man who, they feel, is honestly trying to do the square thing. A conciliatory attitude, indeed, is more likely to *save* expense than to *cause* it.

"Several years ago we were erecting a building in the Fall River shipyard. The Admiral, to whom we were responsible for the work, was inclined to be exacting and gruff. One afternoon the architect of the building called me up on the long-distance telephone and announced that the Admiral was positively foaming at the mouth—that he had branded the job as 'all wrong' and swore he would not advance us another cent. The next morning I joined the architect, and we went to the Admiral's office. He was out but expected back shortly. While we were waiting for him to return, the architect, dismayed at the thought of the approaching storm, took French leave and caught the next train back to Boston. When the Admiral showed up I invited him to go over to the building with me and indicate what was wrong.

APARTMENT HOTEL, 12 EAST 86th STREET, NEW YORK CITY

Photograph taken June 15, at which time plastering and trim were well under way

"'Now, that isn't right,' he suddenly barked, pointing to a recently installed railing. 'Of course it isn't, I agreed instantly. 'Tell me how you want it, and I will see that it's fixed at once.'

"Apparently much surprised, the Admiral told me what his idea was and I instructed the Superintendent to make the change. As we walked on through the building he called attention to several other unimportant things he wanted corrected. In every instance I agreed with him promptly. Presently I noticed his belligerent spirit was getting less eruptive. It flared up again, however, as we stepped into a large room in which the entire floor had been laid very recently.

"'What do you think of that?' he shouted.

"I looked the floor over. It was thoroughly serviceable, but in one or two respects it failed to reach the highest grade of workmanship. I knew, however, that it would cost a lot of money to take the floor up and do the job over.

"'Well, what do you think of it?' repeated the Admiral.

"'It doesn't come up to our standard,' I admitted.

"'What are you going to do about it, then?'

"'Anything you want me to,' I smiled. 'Shall we do the whole job over?'

"All the belligerency in the bluff old man's attitude dissolved like a puff of steam. 'That's dog-gone square,' he said genially; 'but I really don't think it'll be necessary. I'm planning to use this for a drafting room and we don't have to be so awful fussy about the floor. If you will fix up everything else I have men-

tioned, we will shake on it'; and he held out a strong, sunburned hand; 'I certainly appreciate your attitude.'

"From that moment the Admiral was perfectly friendly, and we finished the job peaceably and profitably. But if we had tried to quarrel with him over our 'rights' we'd have been in hot water up to the finish.

"A few years ago we were putting up an office building in Providence, R. I., on a 'cost plus' basis. Before starting the job we estimated what the cost would be, and the engineers representing the owner made an estimate that closely paralleled our own. But a lot of things happened before the job was finished. Wages were raised; certain avenues of transportation broke down; and the owner made several changes in the design of the building. All this resulted in the final cost being somewhat more than we had estimated. You must remember, however, that we were working on a 'cost plus' basis; that our estimate had been purely gratuitous, and it had nothing binding about it.

"When the job was done, the owner complained that he had taxed his resources in raising the amount of money that we had estimated as the cost, and that it would be a great hardship for him to raise more. Thereupon we cut $10,000 from the total figure—which was three-fourths of our entire commission. So far as profit is concerned, the job might just as well have been marked off our books; but we left a satisfied customer, which, after all, is the best advertisement.

"We have made it a business practise that, whenever there is a difference of opinion between ourselves and the owner," said Mr. Ley, "we sit down and tell him our side of the story; then we listen to his side. If we can't convince him that we are right, after a frank talk, we just do things his way. Nothing is really done right, you know, unless the man for whom you are doing the job is satisfied—provided he is at all a reasonable human being.

"But there is a deeper obligation even than this. That is the necessity for doing things right, for doing them the best you know how, whether the other fellow is paying attention to you or not. This is the wisest policy from a purely selfish and material standpoint, as well as from a moral one. If you don't do a thing right in the first place, you usually have to do it over, anyway; and then you have *two* costs to meet. It's an old and true axiom that the best way is the cheapest. We have found that money spent in trying to dig up less expensive *substitutes* is a mighty poor investment. And the best way of doing a thing is usually the quickest, too."

"Your history seems to prove that," I remarked. And it is indeed an interesting fact that in the building operations for the last twenty-five years the company has repeatedly established *speed* records for construction.

More Record Jobs

When Charles S. Mellen became president of the Boston and Maine Railroad, in 1910, he decided to signalize his advent into office by rushing the long proposed electrification of the Hoosac tunnel, which pierces the rugged Berkshire hills of western Massachusetts for nearly seven miles. So he gave the job to the Leys. Although bedrock was inaccessible at the site picked for the giant power-house, they sank a great concrete mat for a foundation, and had the building completed wthin sixty days—a record for this type of construction.

During the past twelve years they have erected scores of factories, office buildings, and apartment houses in the East, built ships, and embarked on almost every kind of construction work, until they have developed the most diversified organization of its kind in the country.

A war job with far more numerous engineering problems than those at Camp Devens was the thirteen-million-dollar munitions plant for the manufacture of ammonium nitrate that was created in record time at Perryville, Md., during the war period of 1918.

The plant itself covered 35 acres. It was more than a building operation: it was an intricate construction and engineering problem, embracing underground conduits, railroads, streets, power lines; and the construction of a huge power-plant developing 15,000 boiler-horse-power capacity. Into the construction of the plant went 3½ billion bricks, 851 tons of plaster, nearly 5 billion feet of lumber, and enormous quantities of structural steel and hollow tile. In addition to the plant, the contract called for the erection of a complete village, including bunk houses, dwellings, club houses, stores, a motion-picture theater, and a school.

When the Leys started operations on March 3, 1918, the 516-acre tract was a wallow of Maryland mud, through which a team of horses could hardly drag a railroad tie. Four months later, on July 5, the industrial city was practically complete, and the power-house was put in operation.

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Brick Paving in Cambridge, Mass.

From 1901 to 1905, Cambridge, Mass., laid about 25,000 square yards of vitrified brick pavement on a concrete base in a number of streets 40 to 50 feet wide and carrying a fairly heavy traffic, all greatly concentrated by street railway tracks.

The maintenance cost of these streets has been very small, and the pavements are still in serviceable condition after an average of 20 years of service. Other streets have been paved since with brick, most of them still being in service. Where badly worn, some of these have been used as a base for a new bitulithic surface.

—Lewis N. Hastings, City Engineer, Cambridge, Mass., in the *Journal* of the Boston Society of Civil Engineers, Volume X, No. 5.

Making a Profit Out of an Abandoned Pit

By L. T. Beresford
Cleveland, Ohio

THE gravel-washing plant of L. Gage Booth, of Painesville, Ohio, which has been operating only since the middle of the summer of 1922, is producing a nice profit for its owner. The plant is located in an old pit which was opened up by the Baltimore and Ohio Railroad a number of years ago to obtain gravel for ballast. It was abandoned for a number of years, until Mr. Booth took it over and installed modern digging and washing equipment.

At the present time the plant is producing washed sand for highway work, concrete blocks and general building construction, also pea gravel, coarse gravel, and an exceptionally high grade of roofing gravel. The gravel is excavated with a 1-cubic-yard Sauerman "Le Clair" type power scraper operated over a span of 300 feet, which digs and conveys the gravel to a hopper at the foot of the bins, where a grizzly takes out the refuse and large rocks. From there the gravel is fed by a Telsmith plate feeder to a bucket elevator and elevated to the washing box at the top of the bin.

The gravel is here washed, screened and graded, all in one operation. The 40-inch washer and the sand settling-tank are both of Telsmith make. The oversize stone from the screen is returned through a wooden chute to a small jaw crusher, which crushes the stone and feeds it back into the loading hopper, from which it is again elevated to the screen.

The storage bins have a capacity of 225 tons and are divided into three separate bins, one each for sand, pea gravel and coarse gravel, equipped with bottom-dump hinge gates. The bins are supported on four concrete wall footings running across underneath, so that trucks when loading can back the body in under and still keep the cab outside and dry.

The plant is electrically operated throughout with the exception of the crusher, which is operated by a Fordson tractor. This will be changed to an electric motor for next year. The power scraper is operated by a double-drum electric hoist, and the rest of the equipment is belted to electric motors.

The water for washing gravel is pumped from the river near-by with a 5-inch Fairbanks-Morse centrifugal pump direct-connected to an electric motor. The pump delivers 500 gallons per minute and elevates the water against a head of 120 feet through 700 feet of 6-inch pipe. The waste water from the plant is returned through a line of Insley steel concrete chute sections to a settling-pond, from which it drains back into the river as clean water and is used again.

The plant has an actual capacity of 300 cubic

LAYOUT OF L. GAGE BOOTH'S PLANT AT PAINESVILLE, OHIO, WITH THE SCRAPER DISCHARGING ITS LOAD ON THE GRIZZLY, WHERE BOULDERS ARE REJECTED BEFORE MATERIAL IS ELEVATED TO THE SCREENS BY THE BUCKET ELEVATOR

VIEW LOOKING FROM PLANT TOWARD HILL OF GRAVEL THROUGH WHICH A DEEP CUT HAS BEEN MADE BY SCRAPER

yards of gravel in an 8-hour day, operating with three men, one man to run the hoist, one man to work on top of the bins, and one man at the dumping hopper. Practically all the water usually present around a washing plant has been eliminated by adjusting the settling-tank properly so as to deliver as little water as possible into the bins, by using water-tight bin gates for loading trucks and by running a trough or gutter around the bottom of the bins, which catches the seepage and carries it off to one end.

The gravel-pit requires no stripping, and there is enough gravel to last fifteen years at the present rate of output. This sand has been tested and approved by the State Highway Department of Ohio for road work and is a high-grade material for all concrete work.

One More Variety

RUMBLINGS are heard of a move by the bricklayers calling upon the Joint Board for Jurisdictional Awards to make a ruling that will provide a bricklayer-inspector for concrete foundations upon which brick is to be laid.

It is being pointed out that such an inspector would be merely a figurehead, as his views could not hold the official light of city and state inspectors. In addition, the observation is made that such a practise, if adopted, might lead to the placing to no avail of similar inspectors in connection with many other activities of construction work in which brick is used.

—*A. G. C. News-Letter.*

Winter Storage vs. Summer Shutdown

LAST spring, before the weather permitted a square yard of concrete pavement to be laid, Illinois road contractors had more than a million and a half cubic yards of tested and accepted materials—sand and stone—in stock piles. Over a million barrels of portland cement were piled in warehouses on the job, ready for use whenever the weather permitted the pavers to start mixing concrete. These materials were obtained and stored as a part of the contractors' agreements with the state, which included liberal partial payments for material in storage. Thus the contractor's tied-up capital was reduced to a minimum.

In Illinois, the result in concrete road completed during 1923 will be about 1,000 miles added to the state's system. There have been practically no delays in concreting operations due to lack of material. The quality of the material storage is assured by tests at the sources of supply before any shipments are made.

This highly desirable condition of preparedness is made possible only because of the Illinois policy of awarding contracts in the late summer and fall for the following season's construction. Storage of material is required on practically all road contracts, regardless of the time of year awarded. It is usually stipulated that at least one-third of the total material needed for the improvement shall be delivered before construction commences. A proportionate supply must be kept on hand as the work progresses, until all material has been delivered.

This method helps to reduce the summer "peak" on material-producing plants and transportation facilities. It helps to eliminate delays due to lack of material during construction, which are always expensive for the contractor. The "peak" load on the state's inspection facilities is reduced, and the improvement completed with the least interruption to traffic.

—*Concrete Highway Magazine.*

Building Conditions in the United States

Prepared by S. W. Straus & Company

Building Activities Still Gaining

OFFICIAL building reports made from 262 cities to S. W. Straus & Company indicate that the building activities during the next few months will probably equal and possibly exceed the activities of the corresponding months of last year.

It will be remembered that the volume of building permits issued in October last year surpassed that of September for the first time in several years. This record has again been equalled, October permits issued showing an increase of about 26 per cent over permits issued in September this year in the 262 cities. The increase in the same cities over October a year ago was about 32 per cent.

It is interesting to note also that the larger cities are still making the greater gains. In a list of the 25 cities reporting the largest gains in October, the gain over last October was 44½ per cent, and over September of this year it was 35 per cent.

Considering the country by regions, 93 Central cities show the highest percentage of gain over October, 1922 (46 per cent), but 80 Eastern cities show the highest percentage of gain over September of this year (48 per cent).

New York City continues to swing ahead in its building plans for the near future, October permits issued showing a gain of about 50 per cent over last October, and 63½ per cent over the total volume of building for September this year.

SUMMARY OF OCTOBER PERMITS BY REGIONS

No. Cities	Regions	Oct. 23	Oct. 22	Sept. 23	Oct. Gain	Sept. Gain
80	East	130,611,570	103,577,684	91,894,843	27,033,886 26%	38,716,727 48%
93	Central	94,996,101	64,925,539	86,095,001	30,070,562 46%	8,901,100 10%
40	South	20,161,143	18,800,678	17,841,857	1,360,465 7%	2,319,286 13%
49	West	45,189,291	33,580,996	35,967,819	11,608,295 35%	9,221,472 25%
262	Total	290,958,105	220,884,897	231,799,520	70,073,208 32%	59,158,585 26%

TWENTY-FIVE CITIES SHOWING LARGEST VOLUME OF PERMITS FOR OCTOBER, 1923

	Cities	Oct., 1923	Oct., 1922	Sept., 1923	Gain Oct.-Oct.	Gain Oct.-Sept.
1	New York	72,903,031	48,955,851	44,104,374	23,947,180	28,798,657
2	Chicago	27,837,350	14,996,150	27,8 4,705	12,841,200	*37,355
3	Los Angeles	20,541,872	11,580,427	14,099,353	8,961,445	6,442,519
4	Detroit	12,485,880	8,657,180	9,708,727	3,828,700	2,777,153
5	Philadelphia	10,949,310	9,876,025	7,086,060	1,073,285	3,863,250
6	Milwaukee	6,047,773	2,166,079	3,216,501	3,881,694	2,831,272
7	Cleveland	5,733,300	2,928,875	3,875,650	2,804,425	1,857,650
8	Baltimore	3,854,988	3,810,480	2,689,800	44,508	1,165,188
9	San Francisco	3,793,374	4,719,394	2,907,389	*926,020	885,985
10	Boston	3,556,341	2,605,286	2,701,512	951,055	854,829
11	Cincinnati	2,886,860	1,601,570	1,637,435	1,285,290	1,249,425
12	Oakland, Calif	2,759,208	2,316,833	2,147,296	442,375	611,912
13	Indianapolis	2,757,826	2,431,513	1,650,949	326,313	1,106,877
14	Newark, N. J	2,733,463	4,200,602	2,528,632	*1,467,139	204,831
15	Portland, Ore	2,566,335	1,519,185	2,378,060	1,047,150	188,275
16	Jacksonville, Fla	2,442,819	427,041	307,774	2,015,778	2,135,045
17	Minneapolis	2,416,315	1,985,015	2,858,765	431,300	*442,450
18	Kansas City, Mo	2,397,450	1,883,750	2,320,900	513,700	76,550
19	Denver	2,386,600	1,484,500	2,011,000	902,100	375,600
20	Long Beach, Calif	2,336,695	1,248,801	1,405,462	1,087,894	931,233
21	Buffalo	2,306,000	1,648,000	2,831,000	658,000	*525,000
22	Washington, D. C	2,273,096	3,303,018	2,492,668	*1,029,922	*219,572
23	Providence	2,129,200	1,404,500	1,482,900	724,700	646,300
24	St. Louis	2,111,695	2,957,283	5,592,630	*845,588	*3,480,935
25	Pittsburgh	2,061,448	2,503,486	1,814,383	*442,038	247,065
	Totals	204,268,229	141,210,844	151,723,925	63,057,385 44½%	52,544,304 ± 35%

NOTE:—*Indicates loss.

Speed on a Kentucky Road Job

Federal Aid Project No. 57-A in Knox and Bell Counties Making Remarkable Progress

THE Metzel, O'Hearn, Vastine & Lewis Federal Aid job on project 57-A in Knox and Bell Counties, Kentucky, embraces 12½ miles of the Eastern Dixie Highway between Barbourville and Pineville. The work consists principally of concrete base and integral curbs with Kentucky rock asphalt surface. The grading was done last year under another contract. The base is 6 inches thick, and 16 feet wide except on curves, which are increased to 18 or 20 feet, and it is built of 1:2½:5 concrete unreinforced. The curbs are 6 inches wide, of 1:2:3 concrete extending 1½ inches above the base. The rock asphalt surface is 1½ inches thick after compression, finishing flush with the top of the curb. The contract will approximate $400,000.

The contractor is building the entire job from two set-ups. The first was at Barbourville, which is the northern end of the contract. The plant is now located at its final position at Flat Lick, which is about 7 miles from Pineville and 2½ miles from the southern end of the contract. The unloading is being done with an Erie crane on crawler-tread equipped with a ¾-yard Blaw clam-shell bucket. Cars are spotted at the crane by a Fordson tractor, after which the aggregate is removed either to the bins or the stock pile, as conditions require. To facilitate unloading hopper cars, two concrete pits have been constructed at the side of the railroad, from which the dumped material is taken by the clam-shell. This equipment handles 8 to 10 cars of aggregate per day.

The bins are equipped with a pair of Blaw-Knox batchers, one delivering stone or gravel, and the other sand. The hauling of the batches to the mixers is done by a fleet of Ford trucks, the number varying from 8 to 17, depending on the length of the haul. A truck drives under the bin, where it receives its batch of fine and coarse aggregate. It then moves on to the cement platform, where the right amount of cement is dumped by hand over the aggregate. The cement is handled directly from railroad cars to trucks, except where a surplus is received, which goes into the warehouse. Two or three cars of cement are used daily.

On arriving at the finished subgrade the truck is run onto a turntable, turned around and backed to the mixer, and the batch is dumped into the hopper from an inclined portable runway. The mixer is a 21-E Smith, gas-driven, and mounted on traction tread. The mixed concrete is discharged on the subgrade between Blaw-Knox steel forms, where it is compacted and shaped by hand with a wood template.

The Integral Curb

The method of building the integral curb of 1:2:3 concrete is of interest. A portable box is carried along each side of the road, and into this a batch of 1:2½:5 concrete is dumped as required, and enough cement is added to make the 1:2:3 mix. The curb is made by the use of wooden forms built in 12-foot sections and clamped to the Blaw-Knox forms. The wood form is wide enough to be easily handled and is sufficiently flexible to be accurately adjusted to alignment. The first concrete is placed in the wood form by hand and trowel-finished. By this arrangement no difficulty or delay whatever is experienced in forming the curbs.

When the concrete base has partially set and before the curb forms are removed, the surface of the base is scored in three directions by the use of a hand-drawn corrugated roller. The corrugations are about 2 inches apart and extend into the concrete about ½-inch. By pulling the roller across the pavement in three directions a very uniform and positive scoring of the base is secured.

A Barnes Triplex road pump supplies water for the entire operation. The pump is run by a 4-cylinder automobile gasoline engine driving the 3-cylinder horizontal pump through a clutch and gears. The pressure at the pump is 275 pounds and is sufficient to deliver a pressure of 85 pounds at the mixer through 3 miles of 2-inch pipe.

The placing of the rock asphalt is handled in the customary manner by the use of trucks and hand labor, and there is no particular feature of this part of the work which is out of the ordinary.

Unusual genius for organizing and equipping their work has been demonstrated by the contractors in the speed with which this contract has moved. The contract was awarded in October, 1922, but no concrete was laid until April 16 of the present year. Since that date 10 miles of 6-inch base ranging from 16 to 20 feet in width has been completed. The last 5 miles were laid in 34 days and by the actual operation of the mixer for 360 hours. The maximum day's run on the concrete was 1,335 lineal feet in 12½ hours. Of course this record has never been maintained for a period of days, but the average working day has seen 800 feet of base laid and completed. On September 7, 1,030 feet was laid, and on the previous day 995 feet. Five miles of asphalt have been laid and the road opened at the northern end. The maximum day's work on asphalt has been 1,040 feet and the average 850 feet.

The work is being handled under the personal supervision of the four members of the firm, Walter L. Metzel, Owen O'Hearn, Ben M. Vastine and F. A. Lewin. For the state the work is in charge of J. Steve Watkins, District Engineer, G. L. Logan, Assistant District Engineer, and James Gard, resident engineer.

ACKNOWLEDGMENT.—From a recent article in *The Scraper*.

The Production and Uses of Slate for Structural Work

Economy in Construction Possible in Spite of High Prices

By W. S. Hays

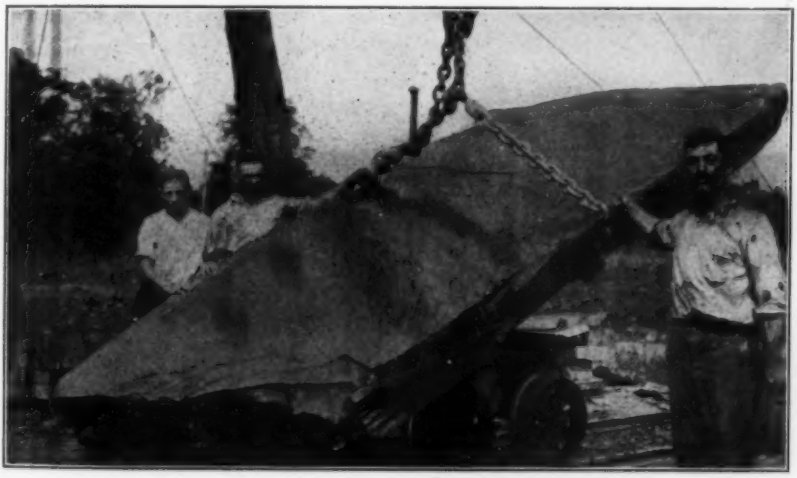
Secretary, National Slate Association, Philadelphia, Pa.

AN exhaustive study of the stone-quarrying industries made by the Bureau of Mines and the U. S. Geological Survey has been responsible in a large measure for making available to the public, through the published reports of Dr. Oliver Bowles, T. Nelson Dale and G. F. Loughlin, the superior service rendered by slate for the many purposes for which nature has endowed it. Incidentally, these studies have promoted a better feeling through interchange of ideas of the producers, on quarrying methods, economies in manufacture and uses.

There is marked recognition of the durability and practicability of slate for structural purposes, its ultimate economy as compared with roofing materials that have to be repaired and replaced, its advantage and economy for electric switchboards and blackboards and other varied uses.

Slate is a sedimentary product of prehistoric geological upheaval and convulsion in the crust of the earth. It is essentially a product of nature and therefore the inherent qualities of it cannot be changed by man. The term "slate" is applied to fine-grained rock that has an almost perfect cleavage, permitting it to be readily split into thin, smooth sheets. .The term includes materials differing widely in color and having a mineralogical composition. Nature has selected and assorted the materials of slate more carefully than man can choose the constitutents of any artificial product, and no hydraulic pressure humanly devised can approximate the mountain-building forces that compressed slate into its dense, compact form. While slate originated from clay, the intense pressure and high temperature have completely altered it into quartz, mica and chlorite, three of the most stable, insoluble and permanent of all minerals. As it consists of such weather-resisting natural minerals, slate is one of the most enduring structural materials the world has ever known.

The more common colors in slates are gray, bluish-gray and black. But there are reds and purples, unfading greens and weathering greens, soft browns and rusty browns, mottled and variegated greens, all of which possess the same properties and qualities as the more common colors. Chemical and mineralogical composition determine the color of a slate, the colors other than gray and bluish-gray being due chiefly to the presence of iron compounds and carbonaceous material. Slates containing considerable proportions of finely divided carbonaceous matter are black. Color is of great economic importance. Some colors are much more in demand than others, the preference being based more on tradition than on artistic taste or



A BLOCK OF SLATE BEING REMOVED FROM THE QUARRY

PREPARING ROOFING SLATE FOR USE—SPLITTING THE BLOCK

actual qualities of the slates. Architects, builders and roofers can widen the field of utilization of roofing slate by judicious efforts to popularize new colors or combinations of colors.

Quarries

High-grade slate usually occurs in narrow beds inclined at steep angles, and the working of such beds results in deep quarries. Commonly, slate quarries are over 400 feet deep, and such deep quarrying is more expensive than the working of comparatively shallow pits. In order to obtain sound blocks of slate, slow and careful methods are used, which involve a great deal of hand labor and are costly. In quarrying comparatively narrow inclined beds, much adjacent barren material must be removed. In many quarries, particularly where blasting is employed, methods are very wasteful, though the introduction of channeling machines has somewhat lessened waste from this cause.

The plan of quarrying is the open pit method, although in Maine the underground method of tunnels and shafts is being operated. Active slate quarrying is confined in America to the states of Maine, Maryland, New York, Pennsylvania, Vermont, Georgia, Tennessee and Virginia. Nearly 50 per cent of the production comes from the Lehigh district of Pennsylvania, including parts of Northampton and Lehigh Counties. The Peach Bottom district, which extends from York and Lancaster Counties across the line into Hartford County, Md., has produced considerable slate. In Canada slate has been quarried chiefly in Richmond County, Quebec, although some slate has been produced in Nova Scotia and in British Columbia. Slates have been obtained from the shores of the Bay of Islands and Trinity Bay, Newfoundland.

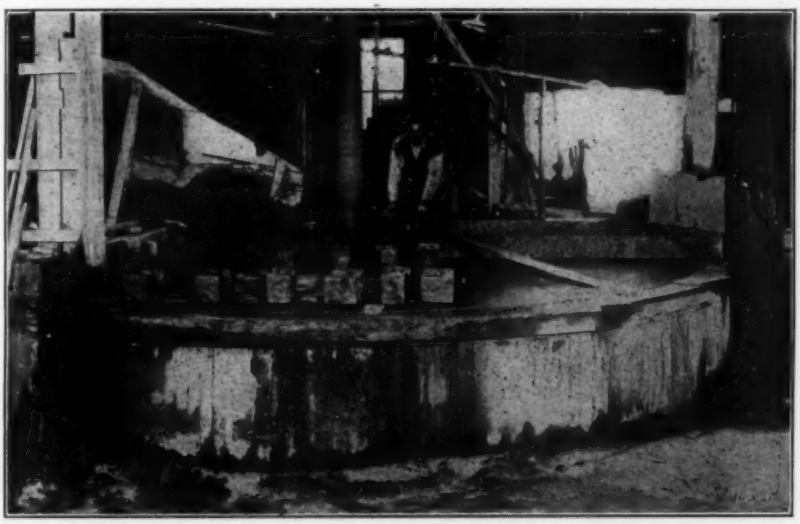
Stripping

Stripping is the process of removing the overburden of soil on the rock surface. The extent of the stripping required depends greatly on the method of quarrying. Some deep quarries on nearly vertical veins have been worked constantly for forty or fifty years without enlarging the original opening, and thus have had no stripping problems since they were opened. Generally, however, even in districts

POLISHING SLATE FOR SUCH USES AS BLACKBOARDS AND BULLETIN BOARDS

where deep quarrying is done, the development of new deposits or enlargement of present quarries demands removal of overlying soil. In districts where slate is taken from wide and shallow pits, stripping becomes more important, and may constitute a considerable share of the quarry expense. Clay, sand and gravel, with broken and decayed rock, are the common overburden constituents. Although the term "overburden" properly applies only to the covering of soil, the upper part of the rock, decayed by water action or shattered by frosts, is closely related to it in that it also consists of a waste material that must be removed.

Compressed-air hammer drills of the non-reciprocating, automatic rotation, hollow steel type are the most popular and are widely used. In a few quarries where no air compressor has been provided, steam tripod drills are used. Churn drills are used occasionally where there is a depth of 20 to 50 feet of waste rock that requires heavy blasting for its removal. Wedges of the plug and feather type driven into shallow drill holes are commonly used for making cross fractures.



RUBBING SLATE—MAKING IT READY FOR ELECTRICAL AND STRUCTURAL USES

Use of Channeling Machines

Channeling machines are now common, particularly in the Pennsylvania slate belt, and their introduction has marked a very great advance. The early method of blasting with black powder not only produced an excessive amount of shattered rock waste material, but the slate blocks obtained were usually angular and irregular. The channeling machines give a smooth surface, shatter the rock for a few inches only at the cut, and provide a ready means of obtaining regular rectangular blocks. The machines may be run by steam or by compressed air; the latter is preferable, particularly in deep pits or in underground workings. The bar channeler, which was first introduced in slate quarries about 1887, consisted of a bar about 12 feet long supported by four iron legs. Drills were mounted on this bar, and by mounting the drills to different positions on the bar, closely spaced holes were projected in line. By broaching out the intervening rock a channel was formed. The process was so slow that it was not widely used. About ten years later the truck channeler was designed. This is the modern type of channeling machine which travels back and forth on a track and cuts out a channel much more rapidly than the primitive bar machines. Wooden derricks and compressed-air hoisting engines are used in the Monson, Maine, district, but in practically all other districts overhead cableway hoists are used. For large pits three to six parallel cableways are commonly required in order to serve properly all parts of the excavation. Supplementary derricks are used at some quarries for hoisting from the pit or for yard service.

Preparation of Slate for Use

The slabs which are usable as mill-stock for blackboard and structural purposes are taken to the mill (after the channeling process) and cut by huge revolving steel saws into the sizes required. From these slabs then are selected the ones which may be used for electrical purposes, which are split by wedges into the desired thicknesses. The ease with which slate may be split ready for the finishing processes is one of the remarkable characteristics possessed by this material. Technically it is known

as "fissility," otherwise as cleavage. It enables the slate to be split as thin as 1/16-inch, a most important asset in the production of roofing slate. Slabs 4 feet high by 8 feet long can be readily split into ⅛-inch thickness for blackboards.

After being split into the required thicknesses, the slate is then put through the finishing processes. The natural split face surface which results, while fairly even, is rough. Both sides are first planed, which results in an even surface showing the marks of the planes. This planed surface is always left upon the back of the slate used for electrical purposes unless explicit directions to the contrary are given. The next step consists in placing the slab on large revolving metal disks where the surface to be finished is rubbed under the action of sand and water. This process results in the standard sand-rubbed finish, a uniformly smooth, even surface showing a slight grain. This finish is sometimes called for in specifications for electrical slate, although in most cases the honed finish is required, and the finish is therefore named as the standard within the specifications.

The honed finish is a polishing process produced by either of two methods. In the one the slate is laid stationary, and rotating heads of carborundum known as "bricks" or "rubs" revolve about 70 times per minute with clear water running over the slate. The second method is by a dry process in which a carborundum belt running over pulleys about 18 feet on centers, travels over the slate at a speed of 3,000 feet per minute.

Following the procedure of the packing industry, where "everything of the pig is utilized but the squeal," the ideal development of the slate industry will be the complete utilization of slate from the most economical point of view: in the large sizes, for blackboard, electrical, roofing and structural purposes, walks and floors; in small sizes for flat roofs, floors, window displays, menu announcements in front of restaurants, fuse blocks, switch bases, fireplace facings, etc.; then the waste from the manufacture of these products should be ground into granules and slate flour for their varied uses.

Slate is adapted to more uses than any other natural stone. The permanence of slate is proverbial. Unaffected by exposure, sparks, moisture, oils, dyes, chemicals and odors, slate retains its resistant, sanitary and enduring characteristics. A slate roof placed on an English chapel at Bradford-on-Avon twelve hundred years ago, has remained through the centuries without paint, patches or repairs and is still in good condition; all of which bears out the statement that slate is economical.

Just as Mr. Wright, an architect, who is also President of the Otter Tail Power Company, found slate economical in Minnesota, so did Mr. Glenn, of H. C. Irons & Sons, contractors, in building the Metropolitan Life Insurance apartments on Long Island, make use of this product of nature—slate, in the vestibules, halls, stairs, platforms, base, etc., because it combined artistic appearance and economical construction with a permanent material easily kept clean.

Depreciation and Maintenance

PROBABLY no question in engineering economics produces more discussion than the method of making provision for renewals or replacement of equipment and structures. There are some who would cover all renewals and replacements under the head of maintenance, while others would cover under this head only the repairs and renewals of small parts due to the current wear and tear of operation.

Out of the voluminous discussion that has occurred in recent years on this point there have been established certain clear principles for the guidance of the accountant dealing with the matter. If depreciation and maintenance are merged and come under one single charge of maintenance to be taken out of operating revenues, it becomes very difficult to determine what the actual up-keep or expenditure for wear and tear is. Every few years the replacement of an important part or unit gives a sudden spurt in maintenance charges, while during years when there is no important replacement the maintenance charges run low. The consequence is that it is extremely difficult to forecast maintenance charges for any particular year, since an assumed charge might be vitiated by the necessity for making an important renewal, possibly occasioned by obsolescence, which properly should be covered by a depreciation allowance.

Another objection to the merging of depreciation allowance into maintenance is the fact that unscrupulous operating officials may defer important renewals for some years in order to make a good showing on operation. If no depreciation allowance has to be set aside according to a fixed policy, this objectionable procedure might be followed for years without detection, and the property might in reality be allowed to run down physically to an alarming extent.

There seems to be no doubt that all major renewals or replacements of important units or important parts of work should be covered by a depreciation allowance fixed upon in advance and rigorously set aside each year. Small renewals and replacements on up-keep incidental to wear and tear are very properly items of maintenance, but to merge with them major expenditures arising from important renewals is a most objectionable financial proceeding for the contractor.

—*The Canadian Engineer.*

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Winter Storage of Construction Machinery

By George F. Smith

President, George F. Smith Company, St. Louis, Mo.

NOW is the proper time to take care of construction machinery so that it will not be injured by the winter weather and so that it may be ready for service in the spring. There are many contractors who seem to overlook this question entirely. The equipment is hauled in from the job to an open lot and there it is allowed to remain the entire winter. Usually no attention is given the machinery until an actual job is started in the spring, and then there is a mad rush to get the machinery on the job.

The proper time is not allowed for overhauling, and there is the further disadvantage that all parts have been badly rusted during the winter, and in many cases machinery is discarded as unfit for use that could have been put in first-class operating condition in the fall. It is also advisable not to delay this matter until too late, as it is not reasonable to expect a man to accomplish the best results on outside work of this kind in raw, wintry weather.

Men can be obtained now who have been working on the job during the past season. These men are familiar with the equipment, and in many cases they know the specific operating troubles that should be corrected. Sometimes a contractor may have some good men in his organization who are not mechanics but are qualified by experience to do a large percentage of this overhauling work.

It is a mistake, however, to expect too much of a "handy man," and it is not fair to the man or to the machinery. There is a lot of work that such a man can take care of, but when it comes to repairing gas engines, magnetos and governors, rebabbitting bearings, or any other machine work, this should be turned over to some competent shop. If machinery is all carefully gone over and put in first-class shape, it can also be appraised and the proper value placed on the contractor's records. This is of assistance in summing up the year's operations.

The cost of overhauling is really in most cases chargeable to the job on which the equipment has been working. By making a practise of thoroughly overhauling all good usable equipment on hand each season and checking up the actual cost of maintaining the equipment, and the depreciation for the year, the contractor will have a much better idea as to the actual equipment charges that should properly apply against his work.

In order to simplify the task of overhauling the machinery, we will try to lay our fingers on the most vital points so that none may be overlooked. We will simply itemize these, and if this list is given to the man in charge of the overhauling, it will help him in his examination of the machinery; and if he will actually check against all these items, we believe the machinery will have been put in such a condition as to be a known quantity when the question comes up as to what equipment is ready for service.

We will not attempt to itemize all operations for every machine the contractor uses, but will select a few representative machines.

On any machine the first thing to do is to ascertain as far as possible the new parts that are to be ordered, so that the parts will be on hand at the proper time. This should be done before the actual work is started, and the larger parts can be ordered by freight. If the repair survey is not made, many items are often slighted on account of inability to get them in time; or, when they are ordered by wire and shipped by express, there are usually attendant delays and unnecessary expense.

Concrete Mixers and Pavers

These machines have been working under probably the worst conditions that any machine is expected to operate under. Full allowance should be made for this fact, and all mixers should receive exceptionally close attention:

1. Remove all concrete, dirt, grease and oil from the machine. Do not overlook cleaning out the inside of the drum and chipping the concrete out of the pockets in the corners and around the blades.

2. Inspect the drum rollers and bearings. If rollers are "bumpy," have them turned down in a lathe or order new rollers.

If bushings are worn, replace them.

Clean out all grease and oil holes and fill with clean grease.

Inspect the drum carefully and straighten out any dents. Dents mean high spots, which wear through quickly and ruin drum.

Examine drum gear or sprocket for cracks or broken teeth.

3. Repair or install new blades if blades are worn down. Worn blades mean decreased mixing and discharging efficiency.

4. Go over all rivets on truck and frame and see that they are tight. Often many parts are thrown out of alignment by loose riveting.
5. See that the discharge chute mechanism works freely.
If discharge chute is worn short, put in new chute or the proper repairs.
6. Inspect all gearing, sprockets and chains and see that they are in proper alignment. All gears with teeth worn to a "knife edge" or chipped should be replaced.
7. Inspect all bearings and bushings. Rebabbitt all worn bearings.
8. Take the side loader clutch apart. Clean thoroughly and replace or repair any worn part.
9. If side loader skip has been pounded out of shape, straighten out carefully or install new plates.
Replace side loader cables if not in perfect condition.
10. Inspect water-tank; see that all valves are in good condition and that tank does not leak.

Steam Engines

1. See that valve faces are in good condition and that valve is properly set.
Grease well and install new gasket.
2. Rebabbitt bearings. Use plenty of shims for later adjustment.
3. See that connecting rod and wrist-pin are in perfect condition. If worn, replace.
4. Also cross-head shoes and slides.
5. See that keys are tight and properly safeguarded against slipping.
7. Remove cylinder head; inspect cylinder walls and piston rings.
Grease all parts thoroughly to prevent rust before replacing cylinder head.
Install new gasket.
8. Remove piston stuffing box gland, put in new packing.
Do not tighten boxing too much, as it is better to do this when actually starting operation.
9. Inspect eccentric and eccentric yoke.
10. Take governor apart; see that gears are not worn too badly, and replace worn bushing or stem.
Grease well and store in box with fittings.
Also examine governor belt. Take off and store with fittings.
See that box is properly tagged, with list of contents.
11. Go over all fittings, lubricator, oil cups, valves, etc.
Replace cracked or damaged parts with new.
Store in box properly tagged, with list of contents.
12. Thoroughly clean all finished parts. Cover with heavy grease, or paint with oil and white lead.
If engine is to stand out of doors, cover with oil paper or tarpaulin.
Wire this securely so that children cannot uncover.

Boilers

1. Clean out all soot and dirt from flues and crown sheet.
Inspect flues at water-line through water-gage holes.
If flues look bad, have boiler inspected by boiler man and if necessary take out one or two flues for inspection.
If found in bad condition, install new flues.
2. Remove hand-hole plates; clean out scale and wash boiler out thoroughly.
Pour one gallon of cylinder oil mixed with just enough white lead to give it body, in the boiler; fill with water, then drain. This will coat flues and shell with a protective film.
Do not replace hand-hole plates, as air circulation through boiler is necessary to prevent "sweating."
Flues are often ruined through "pitting" when hand-hole plates are not removed.
3. Inspect fire box carefully; make sure that it has not been burned or blistered.
See that rivets are tight.
Remove all ashes and see that boiler "O-G" is clean and in good shape.
Tap "O-G" with hammer to make sure it is not corroding, as this is the point where most boilers fail.
When wet scale is allowed to remain in the bottom of the water leg and ashes are allowed to remain in the fire box, chemical action is corroding both sides of the boiler "O-G" and when this is "gone" the boiler is practically scrap.
4. See that grate bars are in good condition. If not, order new grates.
Inspect injector, clean out thoroughly and inspect pipe.
5. Examine all fittings, valves, safety valve, steam gage, test cocks, etc.
Replace any questionable fitting with new.
Box all fittings and properly tag boxes, with list of contents.
6. Inspect boiler stack and store under cover.
7. Thoroughly paint boiler inside and out.
Cover top of boiler with tarpaulin and secure it so that children or wind cannot uncover.

Gasoline Engines

1. Have engine completely taken down by competent mechanic and have every part examined for wear.
2. Remove cylinder head, clean out all carbon, and grind valves.
Inspect crank-shaft and connecting rod bearings; scrape to a perfect fit, or replace if badly worn.
3. Go over all governor parts carefully.
4. See that cams are not worn and that valve stems are in good condition and are properly set.
5. Clean out carburetor thoroughly and see if needle valve is worn.
6. Clean out dirt and scale in water-tank and cylinder jacket.
7. Take magneto apart and thoroughly clean.
Inspect points carefully and if worn, replace.
Go over all wiring and replace all that is worn or oil-soaked.
8. Wash out crank-case with gasoline; remove all old oil and dirt and fill with fresh oil.
9. Rinse the gasoline tank out thoroughly.
10. Clean out all grease ways and fill with fresh grease.
11. Inspect sight oiler and all other fittings.
Remove and box all fittings in boxes properly tagged with list of contents.
12. Thoroughly grease all finished parts and store engine under cover. Be sure that no water has been left in hopper or radiator, and remove drain plug.
13. If engine is mounted on machine, see that housing is tight and that all openings are closed and made weather-proof.

Steel Towers

1. Thoroughly clean all rusted members with wire brushes and give a coat of good paint. Cheap paint is a waste of money.
Have all bolts inspected.
Run down threads and dip in oil before boxing.
Straighten any bent members.
Be sure that base section has not been strained in removal.
2. Inspect top sheaves, and rebush if worn.
Clean out all grease ways and fill with new grease.

Concrete Chuting Equipment

Concrete chutes that are stored in the open without having been given the proper attention are usually a total loss in a few months.

1. Thoroughly clean out all old concrete and go over chutes with wire brushes.
2. Straighten out all dents. A concrete chute will wear through rapidly at any dent.
If chute metal is in good condition but has one or two holes in it caused by dents, have these repaired with smooth patches.
If chute metal has been worn thin, but hoppers and discharge ends are in good condition, have these chutes lined.
Factory liners can be obtained properly curved to fit, and are easily installed.
A chute will stand more wear and abuse after having been relined than when new, and it is a waste of money to scrap chutes too quickly.
3. Remove and straighten all truss rods, greasing the threads. Store under cover, if possible.
4. Counterweight chutes, steel booms and other assembled parts should be kept properly tagged or separated.

If parts are badly mixed, it is better to reassemble all units on the ground and put identification marks on all members before dismantling.

5. If possible, store all chutes under cover, but if they must be left in the open, see that they have a heavy coat of good paint on outside, and on inside use a slush coat of heavy oil, as paint will retard flow of concrete until worn off.

6. Straighten out all dents in elevator buckets; replace worn rollers, and clean and paint.

7. Concrete hoppers should be straightened out and thoroughly cleaned and painted.

See that discharge gate closes tightly and that operating levers are in proper operating condition.

8. Store chutes, buckets and hoppers so that water or snow will not stand in them. Do not pile anything on top of chutes.

Hoisting Engines

If hoist has done much hard work, send it to a competent shop, as real hoist overhauling cannot be done in the open.

1. Remove steam chest covers; see that valve faces are in good condition and that valves are properly set. Cover with grease and install new gaskets.

2. Remove cylinder heads. Inspect cylinder walls and piston rings. Grease all parts thoroughly to prevent rust. Install new gaskets.

3. Inspect cross-head and connecting rod brasses and replace if worn beyond refitting. See that cross-head guides are in good condition. Cover with heavy grease, or paint with oil and white lead.

4. Remove all old packing and replace with new, but do not draw up tight.

5. Remove drums and inspect bushings and shafts. Have shafts turned down and new bushings made if worn.

6. Inspect friction blocks. Clean thoroughly and cut off any "shoulder."

7. Inspect drum and crank-shaft bearings and re-babbitt if worn.

8. Inspect gears and pinion. Replace pinion if much worn.

9. Inspect thrust screws and friction pins and replace worn parts.

10. See that hoist skids are in good shape and block up off the ground.

11. Go over all bolts and see that they are all tight.

See that finished parts are well covered with heavy grease, and if stored outdoors put tarpaulins over drum friction blocks.

In general, one of the most important things is to see that equipment overhauled in the fall is given plenty of oil, grease and good paint to insure its being ready for immediate operation in the spring. Simply to have a "handy man" hurriedly paint all of the equipment with a poor grade of paint is not enough.

In many cases there will be a coating of rust, scale or old paint that will flake off and allow the weather to have full action. For this reason a good, heavy wire brush should be liberally used to knock off this old rust, scale or paint before repainting is attempted.

If equipment has been properly brushed and then has a good heavy coat of paint and has all finished parts liberally smeared with heavy grease, outdoor storage during the winter will not do a great amount of damage. Contractors are annually losing thousands of dollars by permitting their equipment to stand in open lots between seasons without having been given the proper care. It costs much less to overhaul equipment in the fall than it does to neglect this and leave the machinery exposed to winter weather without proper attention.

We hope that these suggestions may be of some value in calling attention to this condition, so that this waste will be cut down as far as possible and so that the contractors may better know the actual annual cost of their equipment operation.

EDITORIAL NOTE.—Contractors may secure additional copies of these directions by writing to the Secretary, Associated Equipment Distributors, Sixteenth Street Viaduct, Milwaukee, Wis.

The article arranged for the December issue will be contributed by M. H. Hunter, President, Hunter Machinery Company, Milwaukee, Wis., and is entitled "Selecting the Plant Before Bidding the Job."

Tests of Loads Carried by Hollow-Tile Walls

THE Bureau of Standards, Department of Commerce, has just published the results of 32 tests on hollow-tile walls. These walls were 12 feet long by 4 feet high and 6, 8 and 12 inches thick, representing the outer wall of a house. Among other results, these tests showed that a wall with the hollow space or cells of the tile set vertically is nearly twice as strong as one in which the cells are placed horizontally.

Miscellaneous Notes

New Blaw-Knox Office in Buffalo

THE Blaw-Knox Company of Pittsburgh, Pa., has announced the opening of an office at 622 Genesee Building, Buffalo, N. Y., J. C. McQuide has been transferred from the Pittsburgh organization in order that he may assume the management of the Buffalo office.

This new office will serve northern and western New York and adjacent territory and is in a position to give immediate and direct service in connection with Blaw-Knox products, including road machinery, clam-shell buckets, forms, sectional steel buildings, structural steel and other products.

Oil Burner Manufacturers Association

THE American Association of Oil Burner Manufacturers, a national organization of both home and industrial oil burner manufacturers, was recently formed in Chicago. The distribution of accurate data concerning oil burning and the oil-burner industry is one of the Association's principal aims. Wallace C. Capen, Home Appliance Corporation, St. Louis, was elected President, and Leod D. Becker, Editor of Fuel Oil for Heat and Power, Galesburg, Ill., was made Acting Secretary. Temporary headquarters will be maintained at Galesburg, Ill., and Room 605, 20 East Jackson Boulevard, Chicago.

Cutting Concrete Piles with Dynamite

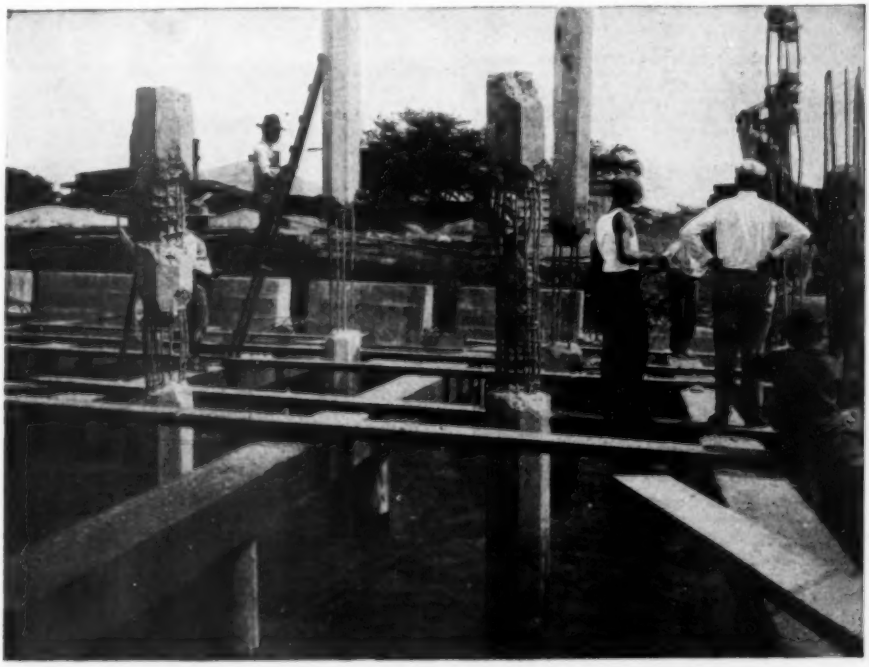
How an Otherwise Difficult Job Was Simply and Effectively Accomplished

By Lieut. Commander S. Gordon (C.E.C.), U.S.N.

SINCE, in the construction of a reinforced concrete wharf at the Pearl Harbor Naval Station, the depth to which the concrete piling would sink could only be determined roughly beforehand, it was not surprising that the driven piles should come to refusal with the butts approximately 7 feet above the desired level. The writer, having noticed the clean break made by dynamite when used to cut off timber piles below the mud line, decided to try this method for cutting off the concrete piles. After exploding a stick of 60 per cent dynamite in a 1-inch horizontal hole cored at the butt of a test pile, the shattered concrete was cut away, the surface smoothed with carborundum, tests for cleavage were made on the concrete with magnifying glass and hammer, and the reinforcing rods subjected to bending tests.

As both concrete and rods were found undamaged, holes were then cored around the butts of the remaining piles, which were shot in batteries of eight. This method enabled the whole piling to be sheared in a remarkably short time, and in no case was the disruptive damage found to extend beyond 18 inches from the center of the charge. By bending the exposed reinforcing rods into the beams to be carried by them, an excellent bond between piling and superstructure was obtained. That the wharf foundations were not weakened by the shots was shown after completion of the wharf, when the damage done by a 250-ton coal barge, in capsizing alongside, extended no further than a small area of shattered deck, which could be repaired at a nominal cost, and did not in any way affect either the beams or the piling.

ACKNOWLEDGMENT.—Courtesy of *Explosives Engineer.*



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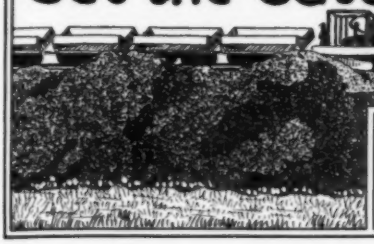


The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

DISTRIBUTORS FOR BITUMINOUS MATERIAL

The Kinney Manufacturing Co., 3529 Washington St., Boston, Mass., will be pleased to send you its descriptive literature on the Kinney auto heater and distributor for heating and applying under pressure all varieties of bituminous material for road work.

PRESERVATIVE PAINTS

Booklet No. 148-B, which may be secured free from the Joseph Dixon Crucible Co., Jersey City, N. J., describes the uses of Dixon silica graphite paint for protecting exposed metal work.

STEEL PAVING GUARDS

Godwin steel paving guards to protect edges of streets, roads, curbs and street railway paving, are described in illustrated catalog No. 23, which may be secured from the W. S. Godwin Co., Inc., 12 E. Lexington St., Baltimore, Md.

A SHOVEL, DRAGLINE EXCAVATOR AND CRANE

The new 20-B Bucyrus gasoline-operated shovel, dragline excavator and crane, which has many features of interest to contractors, is described in Bulletin F-201, which may be secured free from the Bucyrus Co., S. Milwaukee, Wis.

MORE WORK FROM GRADERS

The latest booklet of J. D. Adams & Co., Dept. CEM, Indianapolis, Ind., tells why Adams adjustable leaning wheel graders do more work per day or per dollar of operating expense.

COLD PATCHING FOR ROADS

The Barber Asphalt Co., Land Title Bldg., Philadelphia, Pa., has issued a 16-page booklet describing the use of the Barber brand of cold repair cement for repairing roads and for the construction of grade crossings and station platforms.

MAYARI PIG IRON

Publication No. 26, issued by the Bethlehem Steel Co., Bethlehem, Pa., describes Bethlehem Mayari pig iron, a natural nickel chromium pig iron for making high-grade castings used in many pieces of contracting machinery.

A TRAILER WITH AUTOMATIC BRAKES

The literature of Whitehead and Kales Co., Detroit, Mich., describes the new W & K model C trailer, which is well built, of light draft, has a reinforced frame and automatic brakes.

A POWER-DRIVEN BRICK-LAYING MACHINE

Bulletin No. 26, issued by the Maroa Mfg. Co., Maroa, Ill., describes the Eureka brick-cleaning machine, which is operated by a small gas or kerosene engine and does the work of four to five men in removing the mortar from old brick, making them as good as new for inside work.

ENGINES THAT GET THINGS DONE

Contractors don't want weak sisters in the way of gasoline engines on their cranes and shovels. The literature of the Climax Engineering Co., 1 W. 18th St., Clinton, Iowa, describes the Climax, "the trustworthy engine," which has the spirit of getting things done quickly and right and is a material aid to the contractor.

TANDEM PAVING ROLLERS

The Erie Machine Shops, Erie, Pa., will be pleased to send its complete literature on Erie tandem paving rollers, which are guaranteed against breakage or wear for five years, to any contractor interested in the possible purchase of a strong, simple, durable and economical paving roller.

A CEMENT ACCELERATOR AND HARDENER

The General Fireproofing Co., Youngstown, Ohio, has issued a booklet describing the qualities of G-F cement accelerator No. 12, which is a colorless liquid that will not corrode reinforcing bars and that is merely added to the gaging water used in mixing concrete to accelerate, harden and prevent frost action in concrete work.

A GENERAL UTILITY INDUSTRIAL TRUCK

The nine models of Clark Tructractors—gasoline-powered, general utility industrial trucks—and their use in the contracting field, where each Tructractor does the work of eight or more men in handling materials, are described in the latest 24-page booklet, TT-10, which may be secured by any contractor interested from the Clark Tructractor Co., Buchanan, Mich.

SELF-LOADING SCRAPERS

Catalog No. 96-A, issued by the Baker Mfg. Co., 585 Stanford Ave., Springfield, Ill., describes Baker-Maney self-loading scrapers, which, with a grading gang of only two or three men, can handle 300 to 600 cubic yards of dirt a day.

TRENCH EXCAVATORS

Why one contractor owns seven Buckeye traction ditchers and other contractors write so favorably concerning them is found in the illustrated literature of the Buckeye Traction Ditcher Co., Findlay, Ohio.

EXPANSION MATERIAL

In a recent 4-page folder the Minwax Co., Inc., 18 E. 41st St., New York City, describes in detail its asphalt joint filler and calking compound for expansion joints in sidewalks, bridges, block pavements, walls and streets.

GOOD ROADS FROM ROCKY FIELDS

In catalog GR-19 the United Iron Works, Inc., Kansas City, Mo., describes in detail its sturdily built crushers, elevators and storage bins, which are in successful use by contractors in many states.

BETTER-MADE WHEELBARROWS

The Sterling Wheelbarrow Co., Milwaukee, Wis., prides itself on its standardized wheelbarrows, which give longer and better service. The company has issued bulletins describing completely its wheelbarrows for all types of contracting work.

STURDILY BUILT CONCRETE MIXERS

Mixers in 3½-foot, ½-bag, 1-bag and 2-bag sizes, with gas engines giving excess power, built to give big yardage, are described in the literature of the Atlas Engineering Co., 3036 Galena St., Milwaukee, Wis.

CONCRETE SURFACING TOOLS

The Abrams double-action concrete surface trowels for easily surfacing concrete roads or sidewalks without experienced help, are described in a folder issued by the Abrams Cement Tool Co., 3819 Grand River Ave., Detroit, Mich.

SAVING TEN DAYS ON CONCRETE ROADS

Solvay calcium chloride is a medium by which contractors can do away with the old expensive and laborious cover-and-sprinkle method for curing concrete roads and may turn over the route to the state, county or city in ten days less time than usual. How this is made possible is told in the literature of the Semet-Solvay Co., Syracuse, N. Y.

HAND HOIST FOR DUMP-TRUCKS

A highly efficient, well-designed and carefully-built hoist for dump bodies up to 3½ tons capacity for hand operation is described in the literature of the Rock Mfg. Co., Waterloo, N. Y.

HOW TO USE CONCRETE IN WINTER

A booklet, "Winter-Built Concrete," recently issued by the Portland Cement Assoc., 111 W. Washington St., Chicago, Ill., describes in detail all of the safeguards which must be taken to insure satisfactory and economical concrete construction in winter.

BETTER ASPHALT STREET REPAIRS

The improved Equitable asphalt heater which softens 1,500 square yards of asphalt paving a day, providing a proper bonding for the old and new asphalt, is a fool-proof machine which does not require hot water to operate. It is described in the new price list and specification sheet of the Equitable Asphalt Maintenance Co., 1901 Campbell St., Kansas City, Mo.

CONVENIENT EXPANSION JOINTS

An expansion joint which is convenient, safe and economical and is made of a high-grade filler asphalt, shipped in crates or boxes weighing about 325 pounds, is described in the literature and price list of the Waring-Underwood Co., Commercial Trust Bldg., Philadelphia, Pa.

SEMI-PNEUMATIC TRUCK TIRES

The remarkable story of semi-pneumatic tires in use by contractors throughout the country is told in the literature of the B. F. Goodrich Rubber Co., Akron, Ohio.

TRACTORS THAT FINISH THE JOB

The latest literature of the Holt Mfg. Co., Inc., Peoria, Ill., tells why contractors in all parts of the country depend on the "Caterpillar" tractor to get all their estimates in and to finish up the job before the close of the working season.

CONCRETE ROAD REINFORCEMENT

The literature of the Truscon Steel Co., Youngstown, Ohio, on its material for making better concrete roads, describes Truscon wire mesh, which comes in flat sheets, furnished in widths and areas as desired. This literature also describes Truscon contraction joints, which provide a definite plane of weakness in pavements, forming a straight crack for contraction or expansion, and furnish interlocking to prevent one section from rising above the other.

HYDRAULIC HOISTS AND STEEL BODIES

Wood Detroit hydraulic hoists and steel bodies, backed by real service stations throughout the country, are used by thousands of contractors and are described in the literature of the Wood Hydraulic Hoist & Body Co., 7924 Riopelle St., Detroit, Mich.

ASPHALT PAVING TOOLS

The entire needs of paving contractors in the way of tar and asphalt heaters, paving tools and pouring pots are outlined in the complete catalog of Littleford Bros., 500 E. Pearl St., Cincinnati, Ohio.

CONCRETE MIXERS THAT MAKE MONEY

The new catalog describing Jaeger Mix-a-Minute concrete mixers tells why these mixers work with a gang of five men instead of eight. This catalog may be secured from the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio.

ECONOMICAL TRACTORS

Tractors which have revolutionized the cost of road construction and maintenance are described in the catalog of the C. L. Best Tractor Co., San Leandro, Calif., which tells of the work of Best "Sixties" and "Thirties."

DETAILS THAT MAKE PAVING MIXERS

The literature of the Koehring Co., Milwaukee, Wis., describes the details which are taken care of in Koehring pavers, to the exclusion of "features," producing well-built, long-lived machines.

STEAM SHOVELS FOR ALL JOBS

You have seen the Keystone excavator with a skimmer scoop ripping up the pavements on city streets; you have seen it with a boom extension and half-yard clam-shell bucket, handling bulk materials; and you have seen it working as a ditcher. Send for the literature of the Keystone Driller Co., Beaver Falls, Pa., and you will learn a lot more about these versatile steam shovels.

ENGINES BUILT TO STAND HARD USE

Contractors wanting information regarding a gasoline engine which they can put on a job without ever having to coddle or coax it and one which stands the racket and doesn't need a skilled machinist to make it deliver the goods, should get in touch with the Hercules Corp., Engine Div., Dept. B, Evansville, Ind., and get the latest literature describing Hercules engines.

CAN CONTRACTORS USE SNOW-PLOWS?

The answer to this question is found in the large number of contractors who use their trucks for clearing city streets in winter and those who have to keep roads open to be able to handle winter construction. The latest catalog of the Good Roads Machinery Co., Inc., Kennett Square, Pa., describes the Champion snow-plow, which can be attached to any heavy-duty truck and turned loose with the assurance that it will keep the road clear of snow.

CURING CONCRETE IN WINTER

The value of Dowflake, an easily used form of calcium chloride for curing concrete roads and expediting concrete construction work in cold weather, is told in detail in the new Dow book, "How to Cure Concrete," which may be secured from the Dow Chemical Co., 361 Jefferson St., Midland, Mich.

ROAD ROLLERS—ALL TYPES AND SIZES

Catalog A, issued by the Buffalo-Springfield Roller Co., Springfield, Ohio, contains complete information regarding Buffalo-Springfield road rollers, which are made in all types and sizes, with or without scarifier attachments.

HOW TO CONSTRUCT ASPHALT PAVEMENTS

If you have not already received a copy of the Stanolind booklet telling the latest methods of constructing and maintaining asphalt pavements, write at once on your business stationery to the Standard Oil Co. of Indiana, 904 S. Michigan Ave., Chicago, Ill., mentioning CONTRACTORS' & ENGINEERS' MONTHLY, and you will receive a copy by return mail.

CUT DOWN HAULAGE COSTS

The latest issue of "Haul-Age," issued by the Garford Motor Truck Co., Lima, Ohio, for truck operators, tells how you may hold down your heavy haulage costs by the use of Garford trucks.

MIXERS AND CHUTING PLANTS

Contractors interested in mixers and chuting plants should get the Ransome literature describing the entire equipment made by this company, thus placing the responsibility with one outfit. The catalogs may be secured from the Ransome Concrete Machinery Co., 1772 Second St., Dunellen, N. J.

ACCURATE STEEL TAPES

Since the only accurate tape is a steel tape, it is wise for contractors to replace their woven tapes with Lufkin "Banner" steel tapes, which are described in detail in the catalog of the Lufkin Rule Co., Saginaw, Mich.

EXPANSION JOINTS IN CONCRETE BRIDGES

The literature of the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, Ohio, describes Elastite expansion joints, which are used in spandrel piers and walls, guard-rails and sidewalks of concrete bridges, as well as in concrete and block-type pavements.

WHAT MATERIAL FOR CULVERTS?

Contractors and engineers facing decisions in installing culverts should examine the literature of the Newport Culvert Co., Inc., 542 W. Tenth St., Newport, Ky., describing Newport genuine open-hearth iron corrugated culverts, which are made in full-round and half-round styles, furnishing a culvert adaptable to every condition.

CREEPER-MOUNTED LOADERS

The latest literature of the George Haiss Mfg. Co., 142nd St. and Park Ave., New York City, describes in detail the latest development in Haiss material-handling machinery, a wagon loader mounted on creeper treads with propeller feeders, insuring the complete filling of every bucket.

EIGHT MACHINES IN ONE

Bulletin 85-X issued by the Excavating Machinery Div., Pawling & Harnischfeger Co., 3819 National Ave., Milwaukee, Wis., describes the eight-in-one feature of P. & H. machines, made possible by the easy replacement of the crane boom by a shovel boom or skimmer scoop, pile-dri er or other equipment.

DRIVING CONCRETE PILES

The driving of concrete piles is not the easiest job in the world, but the right kind of pile hammer makes the job much easier. Send for a copy of Bulletin 31 issued by the McKiernan-Terry Drill Co., 19 Park Row, New York City, describing McKiernan-Terry 9-B and 11-B concrete pile-driving hammers, run by steam and controlled by a throttle.

Do You Know How Truck Loaders Save Money?

The Cost of Truck Loading Is Made Up of Two Factors—the Cost of Putting the Material in the Truck, and the Cost of Keeping the Truck Idle While Loading

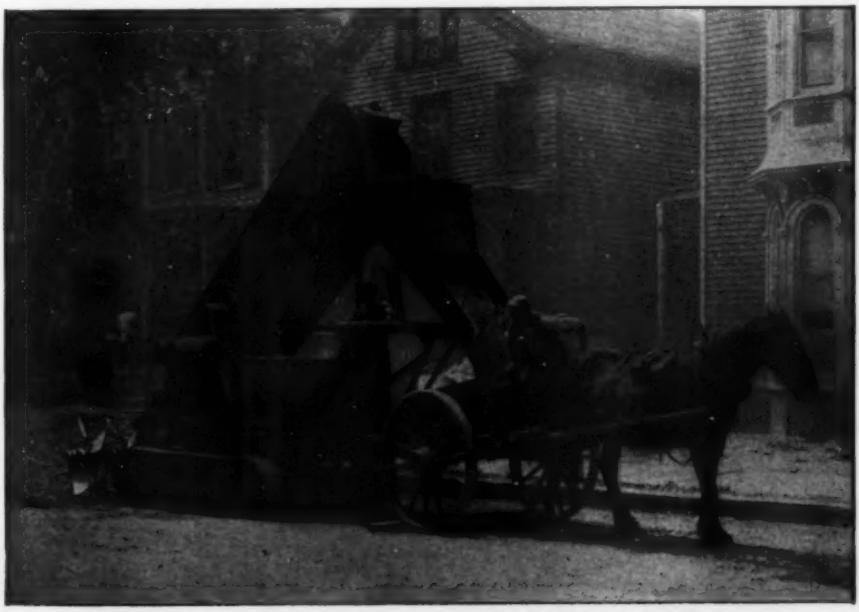
ON road construction in particular, the use of a truck loader is a big money-maker, not only in the saving in actual handling costs, but also in the other economies it makes possible. For one thing, the availability of an efficient method of loading makes ground storage the most practical thing. There is then no need for an investment in an overhead hopper, a structure without reserve capacity and having no salvage value. It is proving better business to maintain storage piles and load direct to trucks. On concrete road jobs the matter of long-haul batch feeding versus roadside stock piles is a matter governed by individual conditions, with the experience records pointing strongly toward the latter method as productive of best results. For one thing, it keeps material in sight ahead of the mixer and saves the yardage which too often is lost when a truck gets off the road and stops production for a time. That loss is directly chargeable to dependence on the long haul. Again, stock piles and short-haul mixer feeding require less truck equipment—another saving.

Comparative Cost Estimates of Hand and Machine Loading

The labor cost of hand shoveling differs with different materials and the heights to which they must be lifted. The heavier the material and the more difficult to handle, the slower the work and the higher the cost. Based on time studies of the rate of hand shoveling and calculating on the basis of a 17-pound load per shovel, the working capacity of a good man is found to be:

Height of Lift	Shovels Per Minute	Cubic Yards Per Minute Sand	Crushed Stone
42 inches.....	12	.07	.042
48 inches.....	10.25	.06	.036
54 inches.....	9	.051	.030
60 inches.....	7	.045	.027

These figures indicate a loading rate which would total about double that which practical experience has shown to be an average day's work; that is, 20 cubic yards of sand into a 42-inch-high truck. For short spurts, it is reasonable to believe that a man can work twice as fast as his daily average. Thus we arrive



THE TRUCK LOADER IS JUST AS USEFUL IN LOADING DUMP-WAGONS

at two rates of shoveling—one the amount of work a man will do in a day, and the other the rate at which he can load a truck small enough to fall into the "short spurt" class. That might be considered as a 10-minute loading job. The table then is:

Height of Lift	Cu. Yds. Per Min. (10 Min. or Less) Crushed Sand	Stone	Cubic Yards Per Day Crushed Sand	Stone
42 inches...	.07	.042	19	11.5
48 inches...	.06	.036	16	10.0
54 inches...	.051	.030	14	8.5
60 inches...	.045	.027	12	7.25

Assuming that shovel laborers cost $4 per 8-hour day, the cost of hand-loading figures ought to be:

Height of Lift	Cost Per Yard Per Man (Average Day's Work) Sand	Crushed Stone
42 inches.....	$0.21	$0.348
48 inches.....	0.25	0.40
54 inches.....	0.285	0.47
60 inches.....	0.33	0.55

It is very apparent that hand shoveling into dump body motor trucks or, in fact, any truck or cart in general use, is a slow and costly method of loading. In working for real man-power efficiency, it will be necessary to use special low-body carriers. On the other hand, there is no penalty for using a high truck when handling material with a loader of the Haiss wagon loader type, as its high discharge chute clears any truck.

The time of hand loading governs the truck waiting cost and is, in turn, governed by the number of men who can work at one time; that is, 5 men at a 5-yard truck, 4 men at a 3-yard truck, or 3 men at a 1½-yard truck.

The time or speed of loading with a Haiss loader made by the Haiss Manufacturing Company, 143d Street and River Avenue, New York City, is governed almost wholly by the availability of the trucks. With an unlimited supply of trucks, there is an undoubted capacity limit, but under average favorable truck conditions a loader can easily maintain a steady capacity of 1½ cubic yards per minute. As an instance of actual performance, the service record of a Haiss path-digging loader on a municipal job where one loader served a fleet of nine trucks is cited. The average time for loading 173 truck loads averaging 3.36 cubic yards each was 35 seconds per cubic yard. The best single performance was loading 3 cubic yards in 55 seconds, and this was in the course of a regular day's work, not a stunt performance. The tabular record of a week's work is as follows:

Number of Trucks	No. of Trips	Av. Yds. Per Trip	Average Loading Time Per Trip	Per Cu. Yd.
6 3-ton.....	155	2.72	1 min. 46 sec.	39 sec.
3 4½-ton...	18	4.00	2 min. 3 sec.	30.8 sec.

Working out a tabulation of comparative costs, taking both loading cost and truck time into consideration, the figures show the distinct value of the mechanical loader. Assume using 1½-yard trucks loading 20 cubic feet of broken stone (for a 1-cubic-yard batch of 1:3:5 concrete) and handling 300 loads per 8-hour day on a short haul from stock pile to paving mixer:

HAND LOADING

19 men will be needed, at $4 per day handling 12 cubic yards each per day.....	$76.00
Truck time, waiting while loading, 300 loads at 7 minutes each, or 2,100 minutes at $0.0209 (trucks at $10 per day).....	43.89
Hand loading cost, 54 cents per cubic yard..	$119.39

HAISS LOADING

1 Haiss truck loader, working to only one-third of its capacity, handling 222 yards of rock per day. Total operating cost, including liberal estimate of 7 cents per yard for up-keep, interest and depreciation.....	$30.70
Truck time, waiting while loading, 300 loads 1½ minutes each (truck at $10 per day).	9.40
	$40.10
Haiss loading cost, 18 cents per cubic yard.	

The following table gives the total sums of money which the manufacturer claims will be saved by Haiss truck loaders over hand labor from various daily capacity requirements and total days used. The sums shown take into account the following items: (1) operating cost, (2) truck waiting expense, (3) repairs, (4) interest, and (5) depreciation. This calculation is claimed to be on a most liberal basis and takes into consideration the most extremely adverse conditions. For instance, the assumed life of the loader is only one-third that of the performance of many machines at work to-day. An extra laborer is also charged against loader operation, an item which is only occasionally necessary. The conditions assumed in these calculations are:

Life of Haiss truck loader—100,000 cubic yards.
Repairs on machine—1 cent per cubic yard loaded.
Interest on investment—8 per cent.
Working day—9 hours.
Gasoline and oil—$2 per day for 1-cubic-yard loader.
$3 per day for 1½-cubic-yard loader.
Labor for loader—1 operator at $6 per day.
1 laborer at $3.60 per day.
5-cubic-yard trucks—$30 per day with driver.
5 shovel laborers—$3.60 per day.
Work per day—15 cubic yards per man.
Truck loading rate—double daily average, or 18 minutes per cubic yard.

These figures are based on equipment and labor costs which are current to-day. It further contemplates the machines as being given reasonable care in operation.

From the prospective user's view-point, the most interesting thing about these figures is that the loader costing $4,000 will pay for itself five to nine times over during its estimated life, if used to more than 20 per cent of its daily capacity. On this same basis the loader will pay for itself in loading the first 20,000 cubic yards.

Finish the Job!

Contractors in all parts of the country always depend on the "Caterpillar"* Tractor to get all their estimates in and to finish up the job before the close of the working season. They find the unrivaled power, speed and traction which the "Caterpillar" shows in mid-summer heat equally necessary to clean up in the fall when every day counts.

Stevens Bros., of St. Paul, who own four 10-Ton "Caterpillars," say: "Our 'Caterpillars' have increased our outputs 30 per cent and decreased the cost of operation a like percentage. By August each 'Caterpillar' outfit had moved as much dirt as we expect a team outfit to move in an entire season."

Let us show you how *you* can make more money on your jobs by the use of "Caterpillars."

* *There is but one "Caterpillar"—Holt builds it*

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Making Tighter Timber Joints

Steel Joint Plates with Sharp Teeth Useful in All Kinds of Wooden Construction

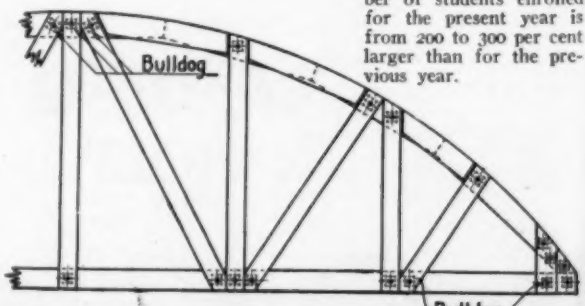
TIMBER joint plates for connecting wooden members of like kinds of wood or hard and soft wood, well known in European countries, have recently been placed on the American market by the Midwest Steel & Supply Company, Inc., 28 West 44th Street, New York City. These Bulldog timber joint plates are especially adapted for reinforcing all kinds of bolted timber construction, giving an increased factor of safety and greater rigidity and strength than with simple bolted or nailed construction.

"Bulldog" plates are provided with strong, protruding, sharp teeth and are placed between the two pieces to be joined, generally having a bolt running through the timber part and through the joint itself. When the bolt is tightened the teeth of the plate sink evenly and easily into both pieces of timber, thus preventing any slipping of the two parts. The plates are made of a special quality of cold-rolled steel and are either coated with a rust protector or galvanized. They are suitable for use with standard bolts where the thread is sufficiently long. Square rolled steel washers of about 4½ times the diameter of the bolt and of about 2/5 the diameter of the bolt in thickness should be used.

These plates have been subjected to very severe tests in several European material-testing laboratories and at Columbia University, New York City. They are particularly adapted for sheds, roof trusses, bridges, scaffoldings, trestles, stables and barns, silos, sawmill buildings, mine buildings, aeroplane sheds, high railings, towers, warehouses, concreting towers and many other timber structures.

A PRACTICAL TIMBER JOINT PLATE

PLATES IN PLACE ON TIMBER USED IN BUILDING PIER TRUSSES, PORT OF TACOMA, WASH.



TYPICAL USE OF TIMBER JOINT PLATES IN ARCH CENTERING

Another Jolt for the White Collar Job

OF the 1,200 night students enrolled in the College of Industries of the Carnegie Institute of Technology, Pittsburgh, about 50 per cent have signed to take the course in the building trades. This division of students is filled with unusual significance to the officials of the institute as representative of the growing tendency of the young men of Pittsburgh to learn craftsmanship. Moreover, according to the report, the increased interest in the building construction courses is confined to no one branch of the industry, but is reflected in each department offering building courses. In some of the departments the number of students enrolled for the present year is from 200 to 300 per cent larger than for the previous year.

ANY paver costs enough, and is a big enough factor in your profit to justify most exacting care in your paver choice!

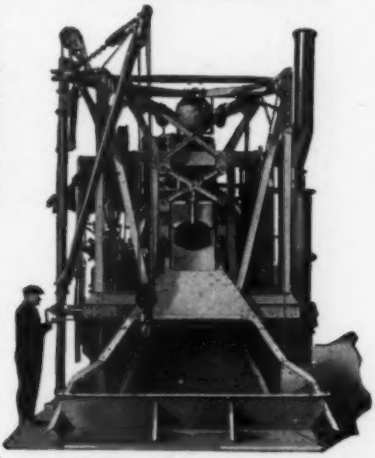
You ought to know all about the Koehring 21-E Paver—not merely the general facts, but the details of construction—because this paver is the product of mature Koehring leadership experience in the paver field, and of the outstanding, inflexible Koehring policy of "Heavy Duty" construction. Beyond question—in its liberal drum dimensions, its day-by-day, season-by-season yardage ability, its high speed operation and "Heavy Duty" construction—this paver is the standard by which to judge paver values. It is worth your while to be thoroughly informed. You do yourself a truly valuable service by writing for the Koehring Paver Bulletin P.

Koehring Capacities

Heavy Duty Construction Mixers: 10, 14, 21, 28 cu. ft. mixed concrete.

Pavers: 7, 10, 14, 21, 32 cu. ft. mixed concrete.

Dandy Light Mixer: 4 and 7 cu. ft. mixed concrete. May be equipped with power skip or low charging platform. Water measuring tank and light duty hoist



KOEHRING COMPANY

MANUFACTURERS OF CONCRETE MIXERS, CRANES, DRAGLINES, SHOVELS

MILWAUKEE, WISCONSIN

Sales offices and service warehouses in all principal cities.

Foreign Department, Office 1370, 50 Church St., New York;
Canada, Koehring Company of Canada, Ltd., 105 Front Street East, Toronto, Ontario;
Mexico, F. S. Lapum, Cinco De Mayo 21, Mexico, D.F.

New Type of Rope Reduces Breakages

Many Advantages Claimed for New Rope Structure Recently Developed

IMPROVED efficiency, greater strength and other valuable qualities in large cordage construction have been obtained in the form of a new rope structure recently developed and covered by basis patents by the Whitlock Cordage Company, 46 South Street, New York City, according to Walter L. Faust, of the technical staff of that company. It is claimed that this new kind of manila rope will undoubtedly effect a very great saving per year to those engaged in construction work.

The Old Type of Rope

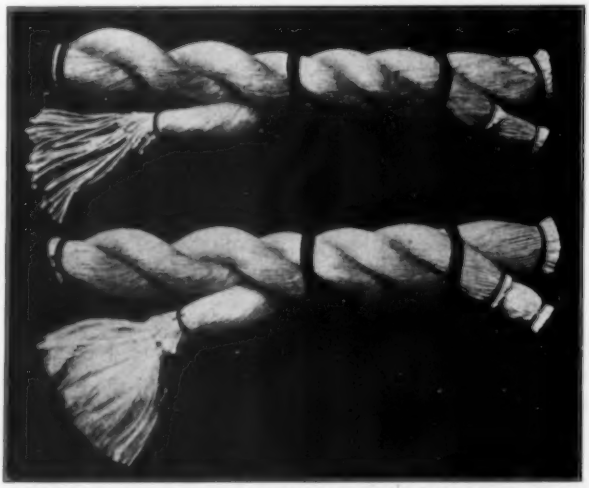
Starting with a bale of fiber, in the manufacture of the older types of rope, the bale is first opened and the hanks fed through various machines functioning to comb the fiber into a continuous ribbon known in the trade as "sliver." The process is continued until the ribbon or sliver is uniform and of the proper size for spinning. It is then sent to machines which spin the sliver into yarn. This yarn, wound on bobbins, is then sent to machines which twist it into a strand. It should be remembered that the strand is made up of layers of yarns, twisted around one another. The yarns composing the outer layers are known as cover yarns, while all yarns below this layer are designated variously as "center," "inner," and "inside" yarns. These strands are then "layed" or twisted around one another to form the finished rope.

With this brief description of the ordinary rope structure in mind, the next step is to examine the manner in which the forces to which rope is subjected act upon the component parts of the rope. Let us picture the rope as a number of tension springs of decreasing diameters, but of equal pitch, coiled concentrically, one within the other. This gives a fairly accurate idea of the various layers within a strand of ordinary rope. To simplify matters, we are considering a strand only and not the rope as a whole. Holding one end of each concentric spring in one hand, imagine yourself extending the set of springs by pulling out on the outer set of ends. The spring in the center, being of the smallest diameter, will have the least length of wire and will be the first to pull out straight for its entire length. No further extension of the outer springs can be made until the wire of the center spring is broken and releases your pulling hand. The further progress of your pulling hand will be arrested by the next spring straightening out. This second spring broken, you proceed to the third, and so on, to the last or outer spring. This proves the truth of the very important theory which has not heretofore been recognized in the rope industry, namely, that the yarns in a strand do not pull as a unit, but rupture successively, layer by layer, beginning with the shortest inner yarns.

The New Rope Structure

Knowing that the ordinary rope, large enough to contain inside yarns, is comparatively inefficient, the problem which Whitlock engineers sought to solve was the construction of larger-sized ropes that would be relatively as efficient as the smaller sizes in which all the yarns pull evenly and work at maximum efficiency because there are no inside yarns. The Fibore rope, which was invented by Herbert V. Whitlock, accomplishes even more than a rope all of whose yarns might be imagined as of even length. It substitutes for the center yarns a core composed of unspun hemp, giving as a strand structure a core with practically no twist and a protecting sheath of yarns. The result of this type of construction makes it possible for the user to actually employ a smaller size of rope than he has ordinarily used, thereby effecting a decided saving of money.

In the manufacture of this Fibore rope the proper number of spinning slivers previously referred to are



FIBORE, A NEW TYPE OF STRONGER ROPE FOR CONSTRUCTION WORK

The Only ACCURATE Tape Is a STEEL Tape.

REPLACE YOUR WOVEN TAPES

WITH THE

LUFKIN

"BANNER"

A Good Steel Tape at Practically Same Price as High Grade Woven Lines.

Equip All Your Crews and Save Time, Trouble and Expense.

On Sale Everywhere. Send for Catalogue.

TAPES AND RULES

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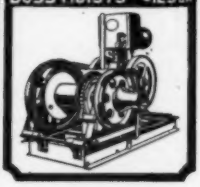

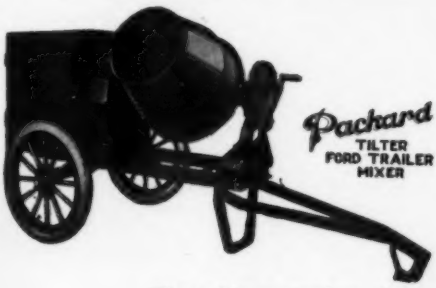

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united to form one large sliver duplicating in weight the center yarns which it replaces. These combined slivers are then fed as a unit unspun to the former, and the cover yarns are placed around them. The strand made in this manner corrects the faults of the strand composed wholly of layers of yarns, in that the fibers constituting the core are all practically of the same length, parallel to each other and parallel to the axis and to the direction of the loading of the strands of yarn.

It is claimed that this new rope has greater tensile strength and a longer life than the older types of rope, is more easily handled both wet and dry, and has less permanent stretch and more elasticity than the usual type of large rope. Furthermore, it is more easily spliced and is claimed to be a distinct advance in cordage manufacture, making a rope which will be of greater value to the contractor.

A New Three-Way Balanced Valve for Concrete Mixers

This Valve Eliminates Metal-to-Metal Seat and Leakage of Water

IN 1915 the Koehring Company, Milwaukee, Wis., began a series of experiments and studies to overcome the difficulty of most three-way valves with metal-to-metal seats, which never were wholly satisfactory because of the unavoidable leakage when the water which the contractors are forced to use contains hard substances that cut the metal contact.

The new valve which they have developed is claimed to eliminate undue wear, as there are no metal-to-metal seats. All of the valve parts which come in contact with the water are either of bronze, brass, leather or rubber, preventing corrosion. The valve is balanced, automatically-operated, non-freezing and self-draining and is completely accessible. The rubber valve discs and the leather plunger which receive the hardest usage were removed for examination from some valves which had been in service for several seasons. They were found in good condition and were continued in service. The rubber discs and leather plungers are standard Jenkins parts carried in any hardware store.

Inspection of the valve is made possible by merely removing three bolts and one pin connection, and the entire unit can be pulled out of the valve body. The valve can be dropped back into place without any fitting or adjusting. A removable house protects the valve and outside valve parts from stone, sand and cement which may drop from the charging skip of the Koehring 21-E paver, which is equipped with this valve.

An additional time-saving feature is the automatic opening of the valve to discharge water into the drum when the skip is raised. The time of opening the valve is adjustable in the valve-operating mechanism, and a hand control is also provided for operating the valve.

A NEW THREE-WAY VALVE FOR 21-E CONCRETE MIXER

For two years this type of valve has been installed on Koehring pavers in the field, functioning under the usual severe conditions under which a valve must operate. These were returned to the factory from time to time for inspection and improvement. The valve now announced is the result of these years of designing, experimentation and tests, and is said by the manufacturer to be the last word in a paver three-way valve design.

The Cost of Steel in Roads

RAPID strides have been made in the last few years in the use of steel in highway construction. The United States Department of Agriculture, Bureau of Public Roads, has compiled data which show that in 1921, the last year of obtainable figures, the cost of the reinforcing material was 2.1 per cent of the total cost of the road. For 1,350 Federal Aid projects involving 7,480 miles of road at a total cost of $112,325,302, reinforcing steel for bridges and road slabs was used at a cost of $2,375,966. These figures show the basis of the percentage. This amount was divided as follows: expanded metal, $50,619; structural steel, $976,571, and reinforcing rods, $1,348,806.

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A Power-driven Brick-Cleaning Machine

A One-Man Outfit with Special Features

A MACHINE which is claimed to clean bricks at a cost of 8 cents per 1,000 for cutting tools has been developed by the Maroa Manufacturing Company, Maroa, Ill. The Model No. 2 one-man outfit is 5½ feet long by 4 feet wide and measures 4 feet from the ground to the top of the engine. It weighs 950 pounds and operates 300 to 600 revolutions per minute as desired.

The cutting tools, which are held into the rotating discs by two bolts, are V-shaped of special cast white iron. Tests have shown that the average cost of renewing these cutting sections is about 8 cents for each thousand bricks cleaned, which is less than the cost of supplying hatchets for hand work. The rotating disc is divided into twelve sections, six of which are cutting sections, the alternate ones being blank. This gives a sharp blow on the brick, which is held against the disc by a plate operated by a foot pedal. When the foot is lifted, the plate drops back and the brick falls away from the rotating disc and is flipped over mechanically.

A GASOLINE-OPERATED BRICK-CLEANING MACHINE IN ACTION

The operator's seat is close enough to the ground to enable him to pick up the brick from the pile and toss them to one side when clean. The outfit can be moved right along the pile by the operator. The mortar from the cleaned brick accumulates at the edge of the outfit, where it can be easily shoveled out of the way, or the outfit can be backed off if moved continuously to the left. These outfits are usually furnished with 4-5-horse-power engines, the air intakes of which are provided with cleaners. There is a clutch on the engine pulley, and the lever is within easy reach of the operator, so that the engine can be disengaged at any time if necessary. The rotating disc is well guarded to provide perfect safety for the operator. Some contractors are making a specialty of cleaning brick with outfits of this type. They keep watch for old buildings that have to be wrecked and places where fires have occurred and buildings have to be torn down. With the present cost of brick and freight rates, it means a big saving to be able to salvage brick, and with this outfit old brick are made as good as new brick for inside work.

Link-Belt Acquires Meese & Gottfried Company

THE Link-Belt Company, Chicago, Ill., through its President, Charles Piez, has announced the purchase of the Meese & Gottfried Company of San Francisco, Los Angeles, Seattle, and Portland. For the past ten years the Link-Belt Company has been distributing its products on the west coast through its subsidiaries, the Link-Belt Northwest Company of Seattle and the Link-Belt Pacific Company of San Francisco. The improvement in distributing facilities effected by the consolidation and the additional manufacturing facilities acquired should give the rapidly growing industry of the Pacific Coast highly economical and efficient service.

The Meese & Gottfried Company and its predecessors have been manufacturers of power-transmission machinery and distributors of conveying and transmission machinery on the coast for more than 40 years. It is the intention of the new owners to add to the facilities and enlarge present stocks so that prompter service to customers throughout the West may be insured.

The new organization will be known as the Link-Belt Meese & Gottfried Company, with headquarters at San Francisco and with the following officers: Charles Piez, Chairman of the Board; B. A. Gayman, President; Harold H. Clark, Vice-President and Sales Manager; Leslie W. Shirley, Treasurer; Richard W. Yerkes, Secretary. The officers, plants and warehouses of the new company are as follows: 19th and Harrison Streets, San Francisco, Calif.; 400 East Third Street, Los Angeles, Calif.; 820 First Avenue, South, Seattle, Wash.; and 67 Front Street, Portland, Ore.

Open to Traffic in 10 Days!

Photo not retouched—just as it is, no hair cracks, a perfect surface cured by Solvay Calcium Chloride.

THE concrete on the road pictured above was placed October 5th and 6th and the road was opened to traffic on October 16th!

State and County Engineers, wherever Calcium Chloride curing has been used, are unanimous in their commendation. Results are certain with Solvay because it automatically proceeds with the curing. There is no worry concerning daily sprinkling, no expense for inspectors. Once Solvay is applied the curing goes ahead and you quickly have the road in use, a strong perfectly cured concrete highway.

In addition to curing concrete, Calcium Chloride, when mixed with concrete gauging water, provides four very desirable conditions:

1. **Accelerates the initial and final set and increases the early tensile strength.**
2. **Gives greater plasticity and workability.**
3. **Increases density—waterproofs.**
4. **Increases freezing resistance—freezeproofs.**

It is for use in all concrete work, and for use in mortar, in setting brick. Its efficiency is not impaired by the weather. The action of Solvay enables brick work and concreting to proceed at exceptionally low temperatures, as it lowers the freezing point of water, at the same time hastening the action.

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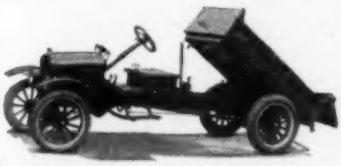

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Distributors of Contractors' Equipment

THE following cards (arranged by states) show the names of dealers in contractors' equipment and supplies with a record of the various lines handled. Contractors will find this list a convenient means of getting in touch with dealers who make a point of giving satisfactory service and prompt shipments. This directory is constantly consulted by our subscribers and any suggestions regarding it will be welcomed. ⁘ ⁘ ⁘

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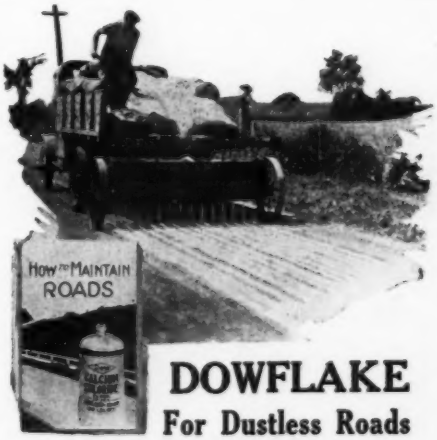

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State of New York, County of New York, ss.:

Before me, a Commissioner of Deeds, in and for the State and County aforesaid, personally appeared EDGAR J. BUTTENHEIM, who, having been duly sworn according to law, deposes and says that he is the Business Manager of CONTRACTORS' & ENGINEERS MONTHLY and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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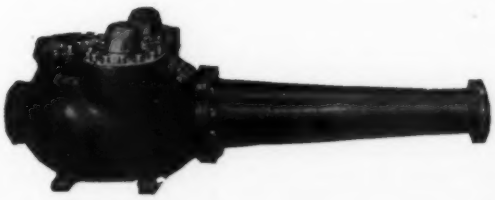

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